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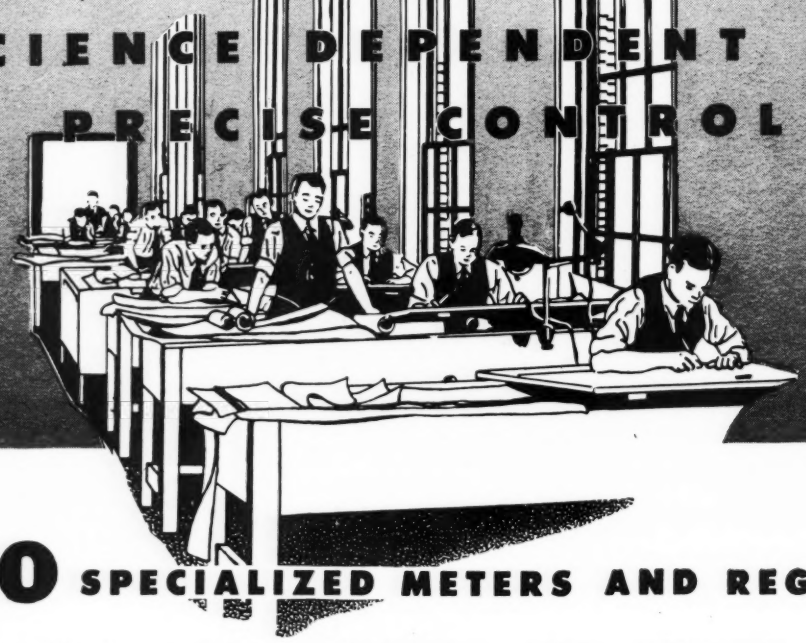

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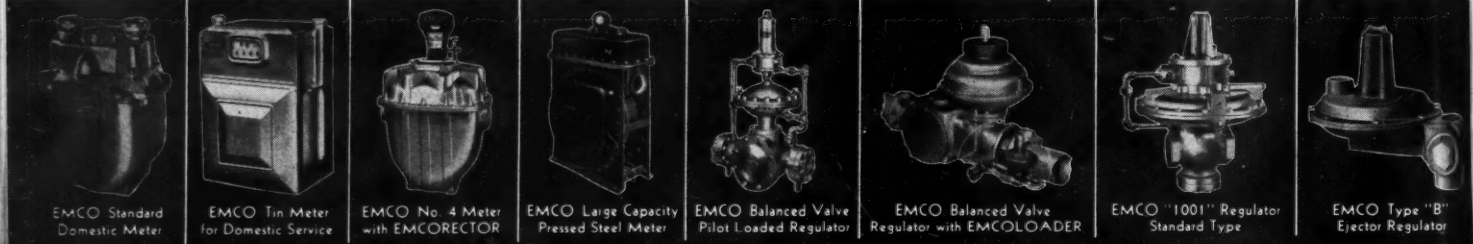

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GAS

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Twentieth Year of Publication

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GUEST EDITORIAL

By ERNEST R. ACKER
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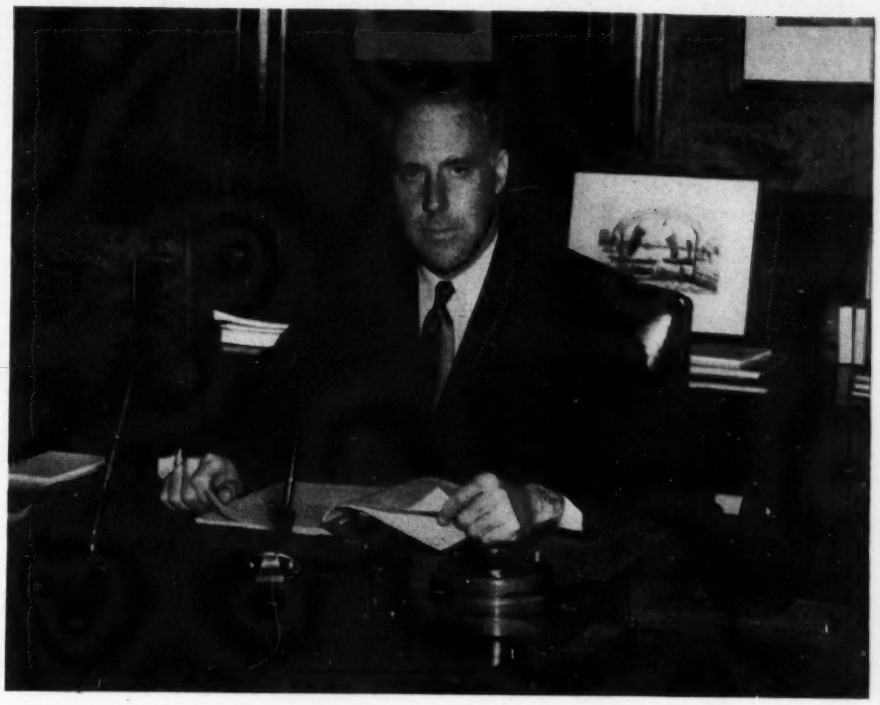

The Plan to Support

THE gas industry is about to be asked to support with its full resources a comprehensive plan of action designed to implement the recommendations of the A.G.A. Postwar Planning Committee as to research, national advertising and general promotional effort. This enlarged plan was approved by the Association Executive Board at its meeting September 13.

The plan is basic. Its recommendations embrace a thoroughly realistic approach to the gas industry's problems and its postwar opportunities. It is quite unlike any plan or program proposed in the past. Moreover, in its application it calls for united effort on the part of the gas industry far beyond that put forth and financed in the past.

The gas industry must make one of the most important decisions in its history, and it must make that decision now. The future of the industry is in its own hands. What that future promises to be depends to a large extent upon the initiative, intelligence and effort which the industry exerts in its own behalf.

Rising costs and aggressive competition have created problems which require immediate and effective action. The industry must unite in a determined effort to improve the economics of its operations. It must at the same time promote its business so that the potentialities of gas service may be realized to the fullest extent. Finally, the important part played by the gas industry in our social and industrial structure should be materially strengthened.

These "musts" reflect the considered opinion of the most enlightened and progressive elements in the gas industry. Favorable action on the part of the industry will not only preserve and extend its markets, but will have a direct bearing on the ability of the industry to attract new capital on more favorable terms in the future than have prevailed in the recent past. I need not stress the point that financial interests are attracted by the securities of those industries which show a progressive spirit and which continually safeguard their future through substantial expenditures for research and aggressive promotional effort.

It is essential, therefore, that the gas industry in its own self-interest demonstrate its faith in the future of its business by appropriating adequate funds for research, national advertising and general promotional effort.

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Thermally Thinking

By ELLIOTT TAYLOR, Washington Editor

Recognition

NEW gas industry promotion plans are currently said to anticipate a considerable measure of financial support from the manufacturers of gas appliances, support which in most cases and under the proper conditions, manufacturers will no doubt be glad to give.

There is one factor, however, which we believe the promoters of the utility sponsored promotion plan should prepare to remedy before asking the appliance makers to join them in any ambitious all-embracing schemes for industry advancement. That is the continued and studied ignoring in all A.G.A. sponsored advertising copy of the existence of liquefied petroleum gas.

The LP-Gas industry now claims to have close to two million homes using butane or propane, and the estimated potential is for double that within a few years after the war.

This represents a market of the first magnitude to the gas appliance industry. Any manufacturer selling into that market is justified in making participation in gas industry promotion conditional on proper recognition of liquefied petroleum gas in all presentations of the future.

The policy of a few die-hard combination companies who insist on regarding LP-Gas as sort of an illegitimate child because it gives their electrical departments a little stiff competition, should no longer be the prevailing attitude of the organized gas industry.

Ambition

A QUESTION of fundamental importance to every natural gas utility, to every producing and pipeline company, and to every state exporting natural gas, is being considered at this writing in Memphis, where the Federal Power Commission is holding hearings on applications of the Memphis Natural Gas Company to construct more gas transmission facilities from Louisiana into Tennessee.

This case, which is a rehearing on an original application denied last June by the Commission, combined with a new application on the part of the gas company, now promises to be the first showdown case on the question of a new FPC concept of its jurisdiction, that it has the authority under the natural gas act as presently written to dictate the end use to which natural gas can be put.

Until January of this year it was, in the words of an FPC document, "the unanimous view of the Commission that inasmuch as Congress had not given it comprehensive powers to deal with the end uses for which natural gas is consumed . . . it was the duty of the commission not to seek to exercise such authority . . ."

The natural gas act was not amended by Congress in the period between January and June, but the Federal Power Commission's concept of its "duty" under the act nevertheless underwent a transformation during the period. For in dismissing the Memphis company's original application, the commisson stated that it was "necessary and appropriate in the public interest that such natural gas resources be conserved insofar as possible for domestic, commercial and superior industrial uses."

Since the rehearings in Memphis constitute, in effect, a re-examination by the FPC of its own position, it is not surprising to observe that the whole affair is being conducted in an atmosphere designed to make the most of testimony in opposition to the interests of the gas company and the City of Memphis, and in support of the commission's original denial of the transmission projects.

With a shrewd and calculating eye cast on the probable review of the whole case by the courts, however, the FPC trial examiner has made every ostensible effort to have the hearings appear impartial and "without prejudice," to use the favorite expression of the commission itself. For the commission no doubt realizes that, if it is able to thus establish its jurisdiction over the end uses to which natural gas can be put, it will have won its regulatory objective without the necessity of convincing congress that greater powers need be written into the basic law as embodied in the natural gas act.

The pressure groups always present in opposition to any proposals favorable to natural gas are, of course, very much in evidence. The assorted interests, including coal companies, mine workers' unions and railway brotherhoods that are spearheaded by Tom McGrath, Washington lobbyist for the National Coal Association, have been accorded both sympathetic and considerate attention by the trial examiner. Coal operators and miners are interested, not in the abstract question of how far FPC jurisdiction extends, but in the very practical proposition that if natural gas is denied any industry or segment of an industry, it will probably have to revert to the use of coal for its fuel requirements. The state of Louisiana is also in eye to eye agreement with the FPC in the matter of this denial because Louisiana has been toying with the idea that if its gas can't go out to industry, maybe industry can be forced to come to the state for its gas.

Probably the realization that FPC supervision of the uses to which gas can be put might even work against the migration of industrial concerns into Louisiana hasn't quite caught up with Governor Jimmie H. Davis, who interposed the lengthy statement in opposition to the Memphis application.

Texas, on the other hand, shows evidence of being more alert. For although Texas, too, has protested the exportation of large quantities of gas from the state, and is pondering ways and means to bring the big gas con-

sumers into the state in search of their required fuel, the Texas Railroad Commission opposes the doctrine that the FPC has the right to consider "the end use to be made of the gas, which matters are in the opinion of the Railroad Commission of Texas outside of the scope of the power of the Federal Power Commission." In other words, Texas wants new industries, too, but she doesn't want to be so handicapped when she has them on the string that they will have to first get FPC permission to use Texas gas in Texas.

One of the most imposing allies of the Memphis company is the new Independent Natural Gas Association of America, which has retained legal counsel to present its participation in the case, and whose attorney has joined with the city of Memphis and the Texas Commission in moving that much of the statement of Governor Davis be stricken from the record.

Natural gas men who have deplored the policy of political unawareness that has characterized the American Gas Association must hail with satisfaction the fact that there has finally been raised an organization voice that can speak with some authority for the industry. It has been a melancholy spectacle to observe over the period of years the growing success and the spreading influence that the coal and railroad lobbies have enjoyed in official Washington at the expense of the gas industry, and never a cogent attempt on the part of natural gas to refute their biased presentations.

We believe also that in the very observation of the manner and the methods of its opponents the natural gas industry may learn much that will stand it in good stead as the battle for extended political control increases in intensity. The coal lobby is willing to make common cause with any fellow traveller whose interests are identical on any vital issue. The natural gas industry need be no less astute. Certainly the interests of manufacturers and processors who want and need natural gas in their operations can most consistently and effectually be combined with those of natural gas suppliers. The oil industry also has a stake in the solution of the problem of natural gas conservation, for at least half of the natural gas marketed is produced in conjunction with, and almost inseparable from, oil production operations.

As the Texas railroad commission has had the foresight to apprehend, Federal control over the end uses of gas moving through interstate commerce can very soon be extended to include practical jurisdiction over the use of gases within the producing states. Other state commissions can and should be brought into line on a home rule policy that will resist the further encroachment of Federal regulation over their own functions.

We believe that a political weakness of the natural gas industry in times past has been its disposition and willingness to go it alone, calling for no assistance from outside its ranks regardless of how closely others' interests might be allied. This we are confident will be a policy reversed before the question of FPC jurisdiction is finally decided, or the decision will be 100% net against the interests of gas.

A committee of the American Gas Association is undertaking the formulation of a policy with respect to the newest FPC threat. We believe that one of the questions that the association should have an opinion on is that of conservation. The broad general line that government spokesmen like to draw, of all political agencies favoring conservation while all industry condones unrestricted waste of resources is as flagrantly unfair as it is patently untrue. If the story of the true economics of gas utilization were told, the public could readily see that low gas rates can only be had at the cost of some diversion of natural gas for what might be called inferior uses.

We believe that many of the hearts that bleed for a gasless posterity would be able to contain their anguish at the plight of those unborn generations if they realized that to save the gas for their future use might well double and even triple the cost of the portion that is consumed today.

These are all fragments of the larger natural gas story that has never been properly told. Yet put together they form a presentation that must be made if the industry is to be allowed to continue in at least a reasonable degree of self-determination along the path that has already made it great in the service of the public.

Application

COMMENCING to trouble the minds of some utility executives who went all out for the A.G.A. laboratory research program is the suspicion that the manufacturers of gas appliances, and particularly of gas ranges, seem to be slow to start experimenting with the specific application of some of the product improvement studies that have been made.

They point out that there are over a dozen research investigations that have reached the stage where manufacturer development could logically be expected to get under way. These include: single point ignition; oven heat loss studies; improved oven and broiler heat distribution; studies on broiler temperatures; top burner improvement; prevention of clogging in air mixers and some advanced and preliminary studies in electrical ignition, non-aerated burners and 100% primary air injection burners for gas ranges.

The extent to which all or any part of the information on these topics, which has been made the subject of numerous research bulletins, has actually been incorporated in the designs of the gas appliances of tomorrow we are, of course, unable to say. We have at times had the pessimistic presentement that a good many manufacturers' plans for postwar models are still in the pre-blueprint or pipe-dream stage.

Any improvements in performance standards of gas appliances that are made possible by laboratory research certainly remain meaningless in a commercial sense until some manufacturers incorporate those improvements into saleable merchandise. The gas companies that backed the idea of increased laboratory research into product improvement did so largely because they didn't want to be caught flat-footed after the war with nothing new to offer in competition with the gaudy promises of the electrical industry. There was a widespread conviction that if the utilities didn't take the lead to avoid this evil, it would never be taken with sufficient enthusiasm and in time to avert that calamity.

We are in agreement with those in utility circles who say that the time has come when appliance manufacturers should let it be known how much or how little value they attach to the laboratory work to date, and how much of it they propose to bring into practical application. We believe that manufacturers could thus render the whole field of gas appliance research a service. If nothing else were accomplished it might indicate what projects could just as well be dropped, and which ones show enough promise to warrant further exploration.

AN ANALYSIS OF ELECTRIC COMPETITION

Can the Electric Industry Double Its Load Per Customer By V+5?

By R. E. GINNA

Assistant to the President, Rochester Gas & Electric Corp.

R. E. GINNA is chairman of the group studying electric competition of the Postwar Planning Committee, which has operated during the past two years under the leadership of A. M. BEEBEE also of Rochester Gas and Electric Corp. His remarks are a portion of a report that was to have been presented before the Annual Meeting of the American Gas Association in Chicago. Other studies in this report which will likely see future publication are (1) "Present Status of the Coordinated Kitchen Program" by C. V. Sorenson and H. V. Potter; (2) "Summary of Engineering Studies" by Hall Henry.

ON ALL sides one hears and reads the claim of the electric industry that it will at least double its domestic consumption per customer in the first five post-war years.

This is an impressive statement, and it has been picked up and repeated so many times in the press that it is now being accepted as a definite post-war objective for the electric utility industry capable of being accomplished and no one would welcome its realization more than myself. The hope is generally accompanied by the explanation that the recessions in industrial war loads with coming of the peace will leave available large surplus generating capacity to take care of the demands imposed by new electric ranges and water heaters, and market estimates (rather than surveys) show a tremendous accumulated consumer demand for such major domestic appliances.

That these complimentary factors will probably exist no one can deny. The trouble with the claim is that it does not take into account actual characteristics of the present annual domestic use per customer and the volume of major appliance sales necessary within five years to effect a 100% increase in the present average annual use. Before resorting to statistical sleight-of-hand, it should be borne in mind that it is admitted there may be isolated areas where such an increase in domestic electric use may be obtained. But the exception does not prove the rule! This article attempts to consider the electric industry as a whole.

During the year 1943, the average domestic use per customer including rural sales for each geographic division of the nation was as shown in Table 1.

Based on a recent survey, conducted by the Electric Light and Power Magazine, asking the electric utilities how many ranges, water heaters and refrigerators they expected to sell in the year V+1 (first post-war year), and after projecting the estimates of the reporting companies so as to attempt to cover all companies in the country, I arrive at the results in Table 2.

By using an estimated annual kwh. usage of 1500 for a range; 3000 for a water heater and 420 for a new refrigerator applied to the above V+1 sales, we arrive at the effect of such anticipated merchandise sales on the present average use per customer after the first year. (Table 3).

Table 3 demonstrates that the estimated Year V+1 sales of ranges, water heaters and refrigerators would increase the national average domestic electric use from 1131 kwh. to only 1203 kwh. Since we are essentially concerned in determining how much of an effort is needed to double the present "use," one can readily compute that *it would take nearly 16 years even at the yearly rate of the estimated V+1 annual sales volume of the three major appliances.*

To put it another way, the present national total sales to domestic electric customers, including rural business, amounts to approximately 31,617,501,000 Kwh. annually. (Table 4). At the ratio of predicted V+1 sales, (namely, 21% of the units to be ranges; 69% refrigerators, and 10% water heaters), it would require the following added appliances to

TABLE 1. DOMESTIC CUSTOMERS AND SALES INCLUDING RURAL

Geographic Division	Year 1943 Customers	Kwh. Sales	Av. Use
New England	2,220,502	2,033,032,000	916
Middle Atlantic	6,859,987	6,252,025,000	911
South Atlantic	2,774,384	3,255,591,000	1,173
East North Central	6,657,177	7,648,474,000	1,149
East South Central	1,259,228	1,608,432,000	1,277
West North Central	2,581,343	2,670,143,000	1,034
West South Central	1,805,334	1,639,486,000	908
Mountain	818,858	1,124,736,000	1,374
Pacific	2,984,524	5,385,582,000	1,805
Totals	27,961,337	31,617,501,000	10,547

*Source—Edison Electric Institute

TABLE 2. ESTIMATE OF YEAR V+1 SALES

Geographic Division	Ranges	Refrig-erators	Water Htrs.	Total Units
New England	40,104	125,000	9,271	174,375
Middle Atlantic	66,284	261,111	15,756	343,151
South Atlantic	55,190	165,388	24,526	245,104
East North Central	114,709	283,040	45,855	443,604
East South Central	31,711	69,470	18,606	119,787
West North Central	42,972	179,499	22,717	245,188
West South Central	20,788	165,644	10,529	196,961
Mountain	16,016	39,403	10,798	66,217
Pacific	84,734	279,307	57,740	421,781
Totals	472,508	1,567,862	215,798	2,256,168
% of Total Units	20.9%	69.5%	9.6%	100.0%

TABLE 3. ESTIMATED AVERAGE KWH USE PER CUSTOMER—YEAR V+1

New England	979
Middle Atlantic	949
South Atlantic	1,255
East North Central	1,213
East South Central	1,383
West North Central	1,115
West South Central	981
Mountain	1,463
Pacific	1,944
Total (U. S.)	1,203

TABLE 4. ESTIMATED ANNUAL APPLIANCE SALES TO EQUAL PRESENT KWH. ANNUAL USE

7,418,376	Ranges	@1,500 Khw.=11,128,000,000
24,615,433	Refrigerators	@ 420 Khw.=10,338,000,000
3,388,029	Water Heaters	@3,000 Khw.=10,164,000,000
	Total Domestic Sales	31,630,000,000

TABLE 5. ESTIMATED NUMBER OF APPLIANCES IN HOUSEHOLDS

Appliance	Northeast	North Central	South	West
Cooking stove—gas	6,885,344	6,617,952	3,910,608	2,891,176
Cooking stove—electric	607,899	1,351,583	808,443	775,019
Water heater—gas (All)	2,034,680	3,129,324	2,134,960	2,193,452
Water heater—electric	185,921	428,245	286,193	302,905

Key:
Northeast: Me., Vt., Mass., Conn., R. I., N. Y., N. J., Pa.
N. Central: Ohio, Ind., Ill., Mo., Kan., Neb., Iowa, Mich., Wis., Minn., N. D., S. D.
South: Del., Md., Va., W. Va., N. C., S. C., Ga., Fla., Ala., Miss., La., Ark., Tenn., Ky., Okla., Texas.
West: Wash., Oregon, Calif., Ariz., N. Mex., Colo., Utah, Nev., Wyo., Mont., Idaho

produce an annual consumption equal to the present load.

Please note that the above relationship still holds to the reasonable V+1 year estimates that for every 100 refrigerators, 30 ranges and 14 water heaters would be sold. Yes, the relationship holds but are the number of each appliances on the beam? I know I have rounded corners and jumped over the moon, but who hasn't? The point is that most anything can be proven statistically but not everything can be statistically proven. Yes, I know that if statisticians were laid end to end it would be a good thing!

Let's look at it another way. How many "all electric packages" (range, water-heater and refrigerator) must be added in five years to double the present total domestic electric annual sales in Kwh.? Still assuming the annual Kwh. values at 1500 for the range, 3000 for the water heater, and 420 for the refrigerator, the answer is 1,285,000 "packages" each year for five years! Compare this with the estimate year V+1 sales of 472,508 ranges. 1,567,862 refrigerators and 215,798 water heaters. And isn't the Gas Industry going to have anything to say?

I realize that I, too, have joined the ranks of those making various unwarranted assumptions but my alibi is that the picture would be worse than that already drawn and then I will be accused of things! Yet, it is obvious that for the electric industry to depend on range, water heater and refrigerator sales to double the present domestic use in the first five post-war years is really "wishing on a star," isn't it?

There is, of course, the lighting load, heating and air-conditioning fans and blowers, television sets, extra radios, quick freezers, cold storage cabinets and many small appliances; truly a formidable list to help swell the post-war domestic electric use. But, such gains may be off-set to some extent by many (at least 40%) of the refrigerator sales being replacement units of greater efficiency, thereby reducing the customers' use. Other factors not to be ignored will be the trend toward smaller homes, apartment house construction to rehabilitate older sections of the larger cities, and housing projects to replace the slum areas, all of which may tend to retard the effect upon consumption of new electric range and water heater installations.

All of the foregoing might seem like a statistical merry-go-round where figures have been tossed about in rather optimistic abandonment. The situation isn't quite as bad as all that, yet it is hoped that the above analyses will encourage more serious attempts to arrive at reasonable estimates of objectives ahead for the Electric Industry.

Such objectives should not and cannot disregard the existence of the Gas Industry. The Post-War Planning Committee of the American Gas Association has presented to the gas industry a vital program of considerable proportions with recommendations of a definite promotional character. These have been very favorably received by the executives of the Gas Industry and active steps are being taken to implement the industry's post-war plans.

This dissertation would not be complete without some indication of what the gas industry faces in post-war markets. A recent saturation survey by the Office of Civilian Requirements of the War Production Board reports the figures in Table 5.

It is claimed by WPB that more than two-thirds of the gas stoves are more than five years old. The gas water heater figures are in some doubt and it is urged that the gas utilities determine immediately how many automatic water heaters they really have on their mains. This information is vital and indicates the need for each company to know its own market conditions, because it is evident that considerable promotional attention should be given to the automatic gas water heater as it affords a definite gain in consumption, whereas the replacement of a gas range merely holds existing business. However, as repeat-

TABLE 6

Number and Type of Utilities (over $5,000,000 in assets)		Total Fixed Capital Amount	% of Total
Straight Gas			
Mft'd. Gas	25	$ 494,790,690	3.0%
Natural Gas	16	$ 771,697,484	4.6
Mixed Gas	9	$ 675,133,934	4.0
Sub-total	50	$1,941,622,108	11.6
Straight Electric	82	5,341,170,024	31.7
Combination Gas and Electric	116	9,543,313,597*	56.7
Total	248	16,826,105,729	100.0%

*About 29% of this total is gas department's fixed capital.

edly pointed out, the statement, "how goes the range so will go the water heater," emphasizes the key part that the range plays in the kitchen picture.

No observations on the "gas versus electricity" problem in the domestic service field can well avoid some reference to the weight of the combination companies on the ability of either the Gas or Electric Industry to reach their respective postwar sales objectives. The analysis in Table 6 of operating utilities, with assets in excess of $5,000,000 each, reveals the relative magnitude of the two industries and the significant size of the Combination companies:

From the above comparison, it should not be difficult to appreciate the importance of Recommendation No. 9 of the AGA Post-War Planning Committee, where in it is stated:

> "Both the Gas and Electric Industries are recognizing that there are definite fields wherein each service is complementary or best and that the combination of services can be to the interest of both the consumer and the utilities."

Now that it is definitely established that the flued and ventilated gas range in the American Gas Association's Coordinated Kitchen Program is a post-war certainty, the comfort-conditioned and clean gas kitchens will become a post-war reality for all to enjoy.

Such gas kitchens of tomorrow with their appropriate electrical features will utilize both services in their proper spheres to the advantage of both customers and utility investors, and at the same time contribute to the fundamentally sound, vital and most efficient use and conservation of the natural resources of the nation.

Industry Problems--Promotional and Political

By GEORGE H. SMITH

Assistant Managing Director, American Gas Association

MY work with the Association as the director of its Natural Gas Department makes it necessary that I spend most of my time on natural gas problems. I have had little opportunity yet to exercise what executive prerogatives may be involved in being an Assistant Managing Director, so I hope you will excuse me if I bear a little heavily on natural gas problems.

Research and Promotional Plan

One problem that involves the entire industry has to do with postwar activities. As many readers know, the Executive Board of the Association authorized the presentation of a plan designed to carry out the recommendations of its Postwar Planning Committee. A special committee was organized and it has now presented a program for the next three years. This plan was approved by the board at its Sept. 13 meeting in New York. (See page 7). It will come up for industry action at the annual meeting Oct. 5.

Briefly the plan sets up an expenditure of an additional one million dollars per year, beyond present expenditures, for three years for enlarged Research and Promotional Development of the gas industry. This annual budget is divided as follows: $600,000 for research, $200,000 for national advertising, and $200,000 for a promotional bureau at headquarters and sales promotional programs.

A splendid program of increased research activities, and sales promotion and developments are set forth in the plan. The costs of the plan are divided between manufactured and natural gas on a basis to give effect to the greater amount of research proposed for the benefit of the manufactured and mixed gas companies. A tentative division of costs allocates about one-third to the natural gas companies and two-thirds to the manufactured and mixed gas companies.

As a justification of the plan the committee has this to say:

"The gas industry has reached a critical point in its need for research and promotional development. Changing economics and the rapid advances of competing services have already had a marked effect upon the industry's position in the cooking and heating fields, and it is clearly indicated that the place of gas as the ideal fuel will be even more seriously threatened in the postwar world.

"The record shows that the average domestic electric 'use' in the past decade has increased approximately 70%, whereas domestic gas 'use' (including space heating) in the manufactured gas industry shows no gain, and in the natural gas industry only 14%. Information further indicates that the electric industry postwar planners contemplate doubling their domestic business by 1950, should the war end as presently expected, and it should be evident that this can only be accomplished by inroads on the gas industry.

"The remarkable growth of the electric industry has been accomplished through extensive and unremitting research, the continuous development of new and improved appliances and the intensive advertising and promotion of the 'electric way' as the modern way of living. In competitive fields the efforts of the electric industry have been effective in spite of the natural advantages and superiority of gas for domestic services, indicating that to date the gas industry has been outadvertised and outpromoted by its electric competitor. The industry is already on notice that the large electric manufacturers intend to further intensify their promotion of electric range sales in the postwar period. The gas industry will be faced, therefore, with the keenest competition in its history and must in its own interest find the means not only to develop new markets but to hold the business which it now has.

"The position of the gas industry is no different from that in which other major industries have found themselves as a result of economic change or too great reliance on price advantage. In every instance the solution has lain in improvement of the product and aggressive promotion of

PROMOTION PLAN APPROVED

Plans for an expanded program of gas utility industry research, national advertising and general promotion calling for an expenditure of $1,400,000 a year for three years were approved Sept. 13 by the Executive Board of the American Gas Association. The new funds will be raised by subscriptions from local gas companies.

the business. These things have been accomplished in numerous instances through increased expenditures for research, effective advertising and intelligent promotional effort based on a thorough knowledge of what the public wants and will buy. Organized efforts along these lines are essential to the future of the gas industry.

"It is obvious that the ultimate relationship with the users of gas service must rest with the individual units of the industry and that the American Gas Association cannot direct or supervise the activities of its member companies. It cannot solve the postwar problems of individual companies, but it can conduct and coordinate those activities of the industry which are common to all and which can be more effectively carried out by group action.

In addition, however, the Association must be in a position to perform services for the gas industry which in the electric industry are to a great extent performed by large manufacturers but which cannot be performed by the comparatively small manufacturers of the gas industry. The fact is that because of the competitive situation between the large number of relatively small manufacturers in the gas appliance field, few, if any, have been in a position to adequately finance the research and promotional needs of the industry by including such costs in the prices of their appliances. For this reason, the gas utility industry itself must assume a large portion of the responsibility for research and promotional effort which in the electric industry is assumed by a handful of large manufacturers.

"It is proposed, therefore, that the gas industry provide funds for increased research, national advertising and publicity and general promotional effort, to implement the recommendations of its Postwar Planning Committee . . ."

That is the committee's proposal. I hope that every gas utility executive will give it most careful consideration when the plan comes before him.

Natural Gas Problems

The natural gas industry is facing today some added attention on the part of the Federal government. Bills before the Interstate Commerce Committees of both houses advocate a study of the whole conservation problem of natural gas. A debate is in progress as to who should undertake the study with the Federal Power Commission and the Department of the Interior making bids for favor. It is anticipated that action will be taken upon these bills this fall.

Thus, the industry will face a long period of study which would aim to make recommendations in the production, transmission and distribution of natural gas in its broad aspects of the public interest. The effect of this may seriously affect some companies if some action isn't taken on the part of the industry to be prepared to lend authoritative information to whatever government agency undertakes the task. Such effort is necessary if we are to protect those whose energies and money have brought such companies to their present economic position. It is important that such a study include a careful consideration of the fact that a large segment of public interest is involved when we consider the interests of employees of, and the investors in, progressive and successful utilities.

Thus, as I view it, the industry can best serve its own interests and that of the general public if men who know the business best take an active interest through the Association in the activities of any agencies charged with studies of conservation of natural gas.

Along these same lines, the natural gas industry has recently been faced with a new problem that has arisen in the granting of certificates of necessity and public convenience under the Natural Gas Act. A large natural gas company was recently denied a certificate (without prejudice) to add pipeline facilities to its system and increase its capacity by 21 million cubic feet of gas per day. In denying the certificate the Federal Power Commission opinion stated as follows:

"In view of the limited natural gas reserves shown in the record to be available to the applicant and thus prevent rapid rate of depletion . . . it is necessary and appropriate in the public interest that such natural gas resources be conserved insofar as possible for domestic, commercial and superior industrial uses." This problem is also one that bears on conservation and will probably be made a part of the natural gas study which Congress will soon pass upon. In the meantime a company is forced with the necessity of proving "superior" uses for its fuel before a certificate is granted and a federal formation of policy is already in the making.

To Develop Policy

To meet this challenge a committee of the Association has been appointed under the chairmanship of Walter Beckjord to discuss all the phases of this question in the hope of developing among us an industry policy.

We are accused by some spokesmen of Federal agencies of being disciples of the old theory of the three "gets"—"get in"—"get ours"—and "get out." Operation under such a theory has already been disproved in the fine records of the managements of our natural gas companies; indeed many of them would well ask "get what?" as their balance sheets are testimony of how little reward they really slave for.

That brings us to another point in this connection which is that of, how superior is natural gas as a fuel and as such what is it worth? I confess that I have no fixed ideas on this as it involves a lengthy study of competition, rates, etc. Natural gas which is otherwise wasted, might better be used as a fuel at any price whether it is considered inferior or superior. On the other hand, I think most enlightened managements would pursue a policy in the marketing of their product at a superior price if old markets can be held and new markets obtained and the whole scheme had a beneficial effect on operating costs and net revenue. That would seem obvious. The difficulty of the whole problem is to get some policy which would not injure some of our companies and yet have public acceptance.

These are pressing problems now before us and our hope is that we can at least get the natural gas industry to present a solid front on what our position should be in the solution of these problems.

NEVER HAVE unity of purpose and harmony within the ranks of the gas industry been more important. The solution of future problems will call for the greatest skill, if the industry is to hold its place in the fuel markets of this country and if it is to make its plans and aims known to the public and those governmental bodies which are destined to control many phases of its business. Now the American Gas Association has been reorganized, and it is the sincere purpose of those who labored on the plan of reorganization to bring harmony to the Association and unity to the industry. No segment of the industry has the power and strength of the whole. The gas industry must work as one to place gas in its rightful place in industry and in the home.

Mr. Smith's remarks were presented at the general luncheon at the 51st Annual Convention of the Pacific Coast Gas Association, Ambassador Hotel, Los Angeles, Sept. 13.

FUTURE SALES EFFECTIVENESS

Can It Be Improved by Joint Utility-Manufacturer Effort?

By W. M. JACOBS

Manager General Sales, Southern California Gas Company

A GREAT many prognosticators, of late, have told us of the huge pent-up buying demands which, released after the war, will keep American industry busy making goods and filling orders.

Probably most of us in the gas appliance business, however, are realistic enough to know that not for long can this demand, of its own momentum, continue to equal output. All are familiar with the fact that war-learned production techniques will turn out vastly greater quantities of home appliances than before. Perhaps sooner than we expect, we will be facing the job of bringing about even higher standards of living, in terms of civilian goods purchased, in order that plant outputs may continue to be absorbed.

Thus is attention to be focused on "sales effectiveness"; for ever increasing effectiveness of marketing processes will surely be the key to mass penetration of markets.

Can joint effort improve this future sales effectiveness? All may not agree that it can. For, it may be said, manufacturers are operating in a competitive system whereunder each must strive for himself. And manufacturers and gas utility companies have different jobs to do. Yet isn't there considerable common ground and mutual interest, and can't better coordination of applied effort "pay off" in improved sales effectiveness?

I. Retail Outlets Constitute Line of Action

First, let me offer the proposition that such coordinated effort should aim at the dealer: *retailing outlets* will increasingly be the line of action in the future distributive pattern. This fact is clearly apparent on our own Pacific Coast, where by far the majority of all ultimate transactions of appliance purchases are carried out by the appliance retailer—in his store, or in the field, but in any event remote from the supplier's doorstep and beyond his direct control. The trend appears to be still further in this direction. And the retailer has become the focal point of the promotional effort of most of our mutual competitors in the home appliance field. It may even be that we will survive future competitive onslaughts only in proportion to the degree to which we have influenced retail outlets to do our job more effectively than the competitors' jobs.

II. Sales and Promotional Training Most Important

Second, let me submit that coordinated effort aimed at retailing outlets boils down to *sales and promotional training*, primarily. I don't want to imply that there hasn't been a lot of this done. But I suggest that more of it—done more effectively by *joint effort*—is necessary. It is, of course, natural and proper for manufacturers to trade on good-will, in doing business with dealers. But is an *affectionate* dealer necessarily an *effective* one? He can't *buy* gas appliances unless he can *sell* them. And I repeat that improving this selling technique appears to be our big job.

I think I make this statement advisedly. Let me give you some examples of undeveloped sales techniques which are all too prevalent in spite of the extensive effort already made by both manufacturers and utility companies. (1) Customers sometimes come to us in utter confusion, saying that they need some heating equipment and have gone to several dealers only to get conflicting advice; that one salesman would recommend one size of furnace which another salesman would label completely inadequate, and so on. (2) We find a similar situation in water heater sales. Some dealers actually advise their customers to buy the cheapest water heater available; "What if it doesn't work quite so well or last as long? You can eventually buy two or three for the price of a top grade water heater now." There is lacking a consistent selling presentation *based on adequacy of hot water service.* (3) A few years ago the two gas companies here in Southern California made several surveys. They were scientifically done, under supervision of professional people. One was an investigation of the types of sales presentations made by appliance dealers selling ranges. I think a few of the highlights from the results might be of interest:

a. Discounting sales arguments concerning features of particular makes of appliances, salesmen selling electric ranges (but not gas) were found to offer, voluntarily, 47% more arguments in favor of electric ranges than salesmen selling gas ranges (but not electric).

b. Salesmen selling both kinds voluntarily offered 100% more arguments in favor of electric ranges; when pressed by questions from the samplers, they dug up a total of 368% more arguments for the electric than for the gas.

c. An examination of the sales arguments used shows more thorough training of electric salesmen in fundamental appeals of electric cooking. Gas range arguments centered around the "nuts, bolts, and gadgets."

d. The samplers were voluntarily given an average of .65 items of advertising

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HARMONIOUS, unselfish, objective cooperation between utility men and manufacturers was primarily responsible for the high degree of succes attained during the past two years by the Pacific Coast Gas Association's Postwar Appliance Committee, on which Mr. JACOBS serves as chairman. This example of outstanding cooperation has prompted the suggestion that similar joint group consideration of many other industry questions of high mutual interest could be of real value. The directors of the Pacific Coast Gas Association have, therefore, approved a program of "Joint Council" meetings, which would supplement, not supplant, the business meetings of the Association's Manufacturers and Sales Sections. Possible examples of subjects of mutual interest might be: improvements in appliances, servicing problems, financing plans, sales campaigns, participation in national promotional efforts, dealer sales training. Says Mr. Jacobs, "I cannot refrain from observing . . . that the cooperation between manufacturers and gas companies on the Pacific Coast has been growing steadily closer and more real. Practical, commonsense cooperation that gets results. I think it is an outstanding achievement." This address was presented before the Manufacturers Section, Pacific Coast Gas Association, Ambassador Hotel, Los Angeles, Sept. 13, 1944.

literature and pamphlets per call, by the electric salesmen, against .4 by the gas. More than half again as many. And the samplers reported "the electric pamphlets were more colorful, interesting, full of pictures, and coordinated with the salesmen's arguments than were the gas."

e. Here are some excerpts from comments in the reports of the individual samplers:

"Electric salesmen all seemed so thoroughly sold on their product."

"Gas dealers seemed passive."

"Electric salesmen all have a cohesive story, but no two gas dealers give you the same arguments."

"Electric salesmen represented a solid and thorough organization and training, in contrast with purely 'personal' salesmanship of gas salesmen."

"Electric salesmen sell 'electric' appliances as opposed to all others; gas salesmen sell only a 'brand' of gas appliance."

"Gas salesmen emphasized gadgets, lift covers, ease of pulling out drawers, red handles, etc., but seemed incapable of matching the fundamental appeals of the electric salesmen."

I hasten to repeat that these are but a few of the results, and this survey was made several years before the war. I am sure the condition was subsequently improved. At least we tried hard to improve it, but I think the problem is still there.

III. A Pattern for Joint Effort to Improve Sales Effectiveness

Third, let me offer what appears to me to be a sound and mutually justifiable pattern for joint effort to improve future sales effectiveness.

A. Gas companies should intensify their basic promotional programs, and their basic sales training programs. More specifically:

1. Utility should make available to retailers the complete "gas fuel" sales story, preferably in some sort of "sales facts manual" form.

2. Utility should make basic "gas fuel" sales training material available to manufacturer personnel, and hold special meetings to review such material.

3. Utility should review special campaigns and promotional efforts with manufacturer personnel prior to making them available to dealers.

4. Utility should prepare and conduct courses in fundamentals of selling methods for personnel of dealers.

5. Utility should hold periodic group meetings of dealer personnel, for personal interpretations of sales objectives and presentation of campaigns or promotional efforts.

6. Utility should make periodic checks or surveys of retailer sales techniques. making general results available to manuturers.

B. Manufacturers should intensify their programs of constructive training of dealer personnel, but with equal emphasis on "product" and "gas" stories. More specifically:

1. Manufacturers should make available more literature, displays, and promotional material, with illustrations, color, imagination.

2. Manufacturer should feature "gas" promotion and appliance "performance" as well as "product" story in all promotional material.

3. Manufacturer should emphasize constructive sales training techniques, building the "product" story on basic "gas fuel" and "performance" story. (Experience shows dealers have over-emphasized the "gadgets," under-emphasized basic performance).

4. Manufacturer should insure participation of his salesmen in special utility meetings to review basic sales material or to preview campaigns and special promotional efforts.

5. Manufacturer should endorse utility's program to dealers, and enlist dealer understanding and support of such programs. (Manufacturers actually do business with dealers, and are often best able to bring about cooperative support. Manufacturers who tear down the utility to dealers, on the other hand, are guilty of action which is destructive of the entire coordinated program.)

6. Manufacturer, as well as utility, should check periodically on dealer sales presentation techniques by samplings or surveys.

Now there is nothing particularly new about most of this. Rather, this proposal merely asks for "more of it," with better coordination between manufacturer and utility, and more emphasis on basic promotion of "gas." I think I can promise that the Southern California Gas Co. intends to carry out its share of this kind of program, even more intensely than before the war.

Plan for Selection of Postwar Salesmen

PUBLIC utilities throughout the country are cooperating in a series of psychological experiments designed to provide an accurate basis for selection of postwar salesmen.

Data collected in 15 cities through the summer by staff members of the Personnel Research Institute of Western Reserve University of Cleveland will be used in preparing a series of tests to predetermine whether job candidates can sell gas heating equipment for home use. Dr. Jay L. Otis, director of the Institute, is in charge of the project.

The research is being underwritten by the Bryant Heater Co. of Cleveland, one of the Dresser Industries. Bryant's president, Lyle C. Harvey, also is president of the Association of Gas Appliance and Equipment Manufacturers.

When the results of hundreds of interviews with men of known sales records, containing nearly 100,000 answers to questions and problems, have been collated, a standard test for gas heating salesmen will be prepared and put at the disposal of the utilities as well as Bryant distributors.

"Not every salesman, even every good salesman, can sell gas heating equipment," Dr. Otis explained, "but individuals already have been discovered who are likely to make a success in this field though they never have been salesmen. An auditor, for example, who took the tests, had an extremely high score. He said it had never occurred to him that he could sell, but after the war he'll change his job, with every sign pointing to a new, successful and better paid career.

"In contrast, a door-to-door necktie salesman rated high on general tests but not on the special aptitudes for selling fairly large items of a mechanical nature, such as a gas furnace. He is the type who needs the stimulus given by continuous small successes.

"We are not going after the petty attributes of salesmanship in this comprehensive series of studies, but the fundamentals. Men who find selling uncongenial are readily weeded out by the tests. Others, who possess the attributes of daring and self-confidence which selling demands, quickly demonstrate those qualities in their answers. A man for example, who buys an expensive car on a small drawing account indicates more faith in himself than a man who puts off buying the car until he is sure of a bigger income.

"Bryant Heater management has illustrated the genuiness of its own interest in a scientfic method of determining sales ability by putting many of its own personnel through the tests. The result has been the disclosure of considerable unsuspected talent. The same is true in general of the preliminary try-out tests with utility companies' personnel. While it is too early to determine the exact form of the final tests, which will be supplied to all gas companies, results thus far indicate that we are proceeding in the right direction."

Planning for the future?

THE future of American industry is not apt to be based upon vague imaginings or half-thought theories. It is going to be mapped out on a cost and return sheet and built of *quality products* which have proved their worth.

"Quality" pipe for gas lines is still NATIONAL Seamless, the "Walls Without Welds" pipe. Even the amazing technological advance under pressure of war necessity has not been able to uncover a better way of making steel pipe; rather it has proved the unique value of this method of pipe manufacture. Piercing a solid billet of steel still gives the best assurance of uniform wall strength. No other among all the processes of making pipe gives the certainty of unvarying resistance to trench pressure, shock, cave-ins, settlement from filled ground, vibration, washouts and similar stresses due to external causes. High tensile strength, adequate ductility, and the absence of longitudinal welds mean easy, economical installation, long-lasting protection and unfailing service.

When you are planning your post-war pipe line construction program, remember the exceptional service record of NATIONAL Seamless Pipe. Because it is available in sizes up to 24 inches and comes from the largest pipe manufacturer in America, you can obtain from one reliable source the exact type (size, wall thickness, length and physical properties) of NATIONAL Seamless Pipe to assure long-lasting, satisfactory service on every gas line job.

USS

NATIONAL TUBE COMPANY

PITTSBURGH, PA.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Export Company, New York

WALLS WITHOUT WELDS

UNITED STATES STEEL

What's Cooking in Washington

By LEONARD MACOMBER

Washington Representative, Association of Gas Appliance and Equipment Manufacturers

WHAT can we expect when Germany is beaten and we are still fighting Japan?

Japan may surrender unconditionally before Germany, but at least the Washington planning is based on Germany surrendering first. In which event, Mr. Nelson states only 60% of production capacity will be needed to beat the Japs. The other 40% can be devoted to civilian production. It even may be 50% cut-back on war production. This, for example, releases more steel than was produced in 1939.

Will Controls Be Released?

Then the question is—will any, or all, Washington controls be released when one of the wars is won. I read carefully the various news items and press releases on the subject of reconversion and so do you. If I didn't know something about the personalities and policies behind the releases, all they could do would be to add to my confusion. First we hear that reconversion is on the way, according to Mr. Nelson. Then Mr. Byrnes issues a directive that labor must be taken from less essential civilian production and given to more essential factories producing war goods. Another Vice Chairman of the War Production Board says they are ready at one hour's notice to cancel all L & M orders. Then the Military says it is satisfied with the Byrnes directive. Finally the press says Mr. Nelson has won his battles and is on his way to China. Then Wilson resigns and is succeeded by "Cap" Krug. This is the picture as I see it.

In the event that only half of our production capacity is needed for war production, Washington will still exercise the strictest control. The Military fears that in the event of a 50-50 military and civilian production and with the tremendous optimism which is sweeping the country, it will find it increasingly difficult to meet its required production schedules. In this opinion, and with its stand I think we must all agree. War contracts, with only hourly cancellation notices and the further prospect of renegotiation, are not very attractive. This applies not only to management, but even more so to labor. The controls will, therefore, continue to be exercised on the workers through War Manpower Commission, and the control of materials through War Production Board.

At the moment, unless some simpler and more democratic method can be found (and I can assure that it is being worked on) CMP will continue to be the method through which materials will be controlled. Through CMP any plant not meeting its war production will find it difficult to get materials for its civilian production. For those of you who have Government contracts—do not let unpatriotic optimism sway even the lowest worker in your plant.

The competitive position of various companies is being given the most careful consideration. Patriotism and competitive position may well go hand in hand.

So do not look for a complete relaxation of Washington controls after one of the wars is won.

Now, how about the postwar and the part Washington control will play in it. Remember I talk only of the thinking *today*. There are a number who believe that all controls will be relaxed or abandoned immediately in the event of a change in administration. That thinking is purely wishful in my analysis of the situation. Government controls will continue.

In the final analysis such controls may greatly help the overall picture and especially our industry, at least for a few years after the end of hostilities. Our industry can reconvert more rapidly than many others. Therefore the allocation of critical materials is necessary in order to prevent the piling up of inventories by other industries not in a position to start production for many months after the war. Our Industry is a preferential industry due to the rapidity with which we can reconvert and employ labor. Some of the reasons for stating that controls will continue after the war are these:

1. I think we will all admit that there is a tremendous pent-up demand for civilian goods; bank statements and bonds held by individuals constitute a huge purchasing power. The thinking is universal that price controls must be maintained to prevent an inflation even more serious than threatens today. I am hopeful that the agency which will control post-war prices will see the picture in the post-war light. A great deal will depend on how our Industry presents its problems.

2. Now add the foreign demand, especially from those countries which have built up dollar credits, to the domestic demand. Our ability to supply can't meet our domestic demand, to say anything of the combinations of both. As a whole our country has not as yet become internationally minded. The tendency therefore will be for manufacturers to fill the domestic demand first, leaving the export markets wide open to foreign competition. Obviously, it's much harder to break into a territory where your competition is already established. Therefore, even some business men will demand a control of exports to insure that American manufacturers will get an equal share in the post-war foreign markets. What form this control will take I am not prepared to state.

I am personally very much interested in this point because of the several months I served with the Maritime Commission. There isn't a man here who hasn't wondered what we are going to do with all the shipping we have built. In my opinion the number of ships which will be tied up in the Hudson River and Puget Sound will depend greatly on a wise export policy of our State Department.

Some of you have expressed the opinion that the saturation point has been reached and therefore you will

DO NOT LOOK for a complete relaxation of Washington controls after one of the wars is won. That, says Mr. Macomber, is the thinking today among the officials who are responsible for providing the nation's material and labor needs during these wars. Mr. Macomber has been guiding the Washington office of AGAEM during most of the war period, and his knowledge of the ways of Washington, together with the promptness and completeness with which he has and is dispatching useful information to the Association's membership has been most helpful and appreciated. This address was presented before the meeting of the Manufacturers Section, Pacific Coast Gas Association, Ambassador Hotel, Los Angeles, September 13, 1944.

question my optimism for postwar business. I will give you again a few of the reasons on which my opinion is based.

First. Of course the pent-up purchasing power and the bond holdings I have already mentioned. It is estimated that the demand for new cars cannot be satisfied in less than four years. This will mean that the fellow who has saved up his money for a new car may not be able to get it for several years. An aggressive sales policy could show him the advantage of putting his money in modern appliances to improve his home and putting away additional savings for the purchase of a new car later.

Secondly. The war has changed our methods of living. Thousands of housewives went to work in shipyards and factories. Many have learned efficiency. Are they going to be satisfied to go back (as a large percentage will) to an inefficient way of doing their housekeeping chores? They may even insist upon having modern appliances before they have a new car. A lot will depend on us as an industry.

Thirdly. I look for a boom in home construction. The building industry has few, if any, reconversion problems. It would be the logical industry to boost, therefore, in the event of temporary unemployment immediately following victory and while reconversion in other industries is under way. I look for a very liberal policy on home financing, not only for returning veterans, but also dislocated war workers. If, moreover, the plans now being discussed in certain circles, of locating industries in smaller towns, materialize, we can expect to find a further demand for many new permanent homes in these localities.

Housing Boom

We must see to it that all of the temporary housing which has sprung up (during the war) is torn down, when expedient. I am a member of the American Gas Association subcommittee on collaboration with Housing Associations and agencies. We frequently get together with officials and executives of the Federal Housing Administration, National Housing Agency, National Association of Home Builders, and a dozen other organizations to exchange ideas, discuss major changes in plans, the latest developments in research work of the gas industry and many other activities. The meat of some of these talks has been passed on to you from time to time.

The general concensus of opinion is that in the housing field, which is so essential to us as an industry, 75 to 85% of the post-war houses will be privately financed. The goal mentioned is a million modern homes a year for the next 10 years.

Already the CIO is asking the Federal Government for an additional half million homes per annum. My guess would be that a post-war housing program of about 1,200,000 homes per year for the next 10 years is possible.

However, there must be many markets which we haven't touched or perhaps haven't even thought about.

I started an idea in the public schools in Washington last winter. I got one of the teachers in an elementary school to use the pamphlets issued by our Water Heater Division as a sort of text book on Hygiene. The name of the pamphlet is "Protecting the Health of the Nation." It was surprising how the thing took hold. I don't believe that one percent of the youngsters in this school ever use hot water to wash their hands during school hours. I don't think many of the rural schools around the country have hot water. An educational program sponsored by Water Heater Division with school and Health Boards might show excellent results.

This is just one idea. There must be other and better ones.

There has been quite a lot of publicity in the eastern papers about the fact that the East is trying to hold its pre-war advantages as sources of supply and thus eliminate the gains the Coast has made during the war. I can frankly say that I have seen no evidence of this to date.

I have mentioned before about the postwar export market. For a lot of this export business, the Coast industries are well located.

Because of my stay in Russia some years ago, I have become quite close to the Soviet Purchasing Commission officials in Washington, the Construction Section. I have the very definite opinion that it will be many years after the war before Russia will have the opportunity to get into the manufacture of such items as we are interested in. Russia has a tremendous reconstruction job ahead and in rebuilding their cities I think the Soviet Government can be interested in a program calling for the construction of manufactured gas plants in many sections. With natural and manufactured gas available as a fuel, it should offer us, I would say, at least a five year market for gas appliances and equipment. Right now, the Soviets are in the market for a large number of coal, oil and wood-burning cooking stoves and heaters. The Russian housing projects I have some information on are stupendous. Let's not allow our competitors to grab off this export business.

Cities Service Announces $1,500,000 Project

S. B. IRELAN, president, Cities Service Gas Co., Bartlesville, Okla., on August 29 announced plans for construction of new facilities to be completed January 1, 1945, at an approximate cost of $1,500,000 subject to approval of FPC and other regulatory authorities.

President Irelan estimates that the improvements will add 32,000,000 cu. ft. of natural gas daily to the capacity of the eastern section of the company's system.

The proposed expansion includes: 52 miles of 16-in. gas pipeline from Shidler, Okla., to Caney, Kan., to carry fuel from the Hugoton field; 6½ miles of 16-in. line in Wilson county, Kan., connecting two existing transmission lines; additions to the Grabham compressor station near Independence, Kan., and to the Petrolia compressor station in Allen County, Kan., at a cost of approximately $200,000.

"This additional gas will furnish ample supplies to meet all domestic demands on the company's east side during the coming winter," Mr. Irelan said. "It also will reduce curtailments of industrial gas to a minimum and will enable the company better to utilize its large underground storage facilities in the former gas field near Welda and Craig, Kan., with capacities of 27,000,000,000 cu. ft."

These storage facilities consist of three large former gas fields near Welda and Craig, Kansas. They are used to store gas in summer from distant fields, some in Oklahoma, and supplies are drawn upon to meet excessive demands of the winter season.

FPC has approved application of the company for construction of a 35-mile link of its pipeline system between Blackwell and Burbank area of Osage County, Okla.

Oklahoma University Plans Research on Drying of Gases

A research project from a chemical engineering point of view, is being conducted at the University of Oklahoma, Norman, Okla., on the drying of gases by activated alumina. The investigation is receiving financial support from the Aluminum Company of America, and is directed by Dr. R. L. Huntington, chairman of the school of chemical engineering, with Professors G. F. Russell and F. F. Blankenship lending part-time assistance.

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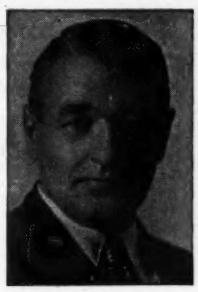
Postwar NOTES and NOTIONS



By STANLEY JENKS

Therms

Talking about the Postwar Planning Committee, I have on previous occasions been sincerely happy to congratulate them on their Report No. 4, entitled "Engineering and Economic Phases of the Gas Industry." I still think it one of the really outstanding constructive studies ever made by and for the manufactured gas industry. As a pattern for postwar load building planning, it merits earnest local application by all companies.

My one gripe is that they did their load estimating in "MCF" with its variables, instead of using "therm," which is definite and puts everything immediately on a readily comparable basis.

Maybe this will be straightened out in the forthcoming similar report on the natural gas industry.

Bye-bye Bunsen

It is assumed that every alert gas man has been following with breathless expectancy the development work being done on the 100 per cent primary air burner by the A.G.A. Laboratory under the direction and supervision of the committee on domestic research. If a non-aerated type burner can be satisfactorily developed for domestic appliances, it seems pretty well conceded that the gas industry has in its grasp the most far-reaching and significant advance in appliance design and gas utilization since the Bunsen burner itself was invented almost a century ago. There is no need, I feel sure, to summarize the many advantages over present design that the non-aerated type promises. The important thing is, how soon are we going to have it available?

The reason I ask is because one of Britain's most reliable gas range manufacturers, Cannon Iron Foundries, Ltd., has already placed its postwar cards on the table and announced that its postwar "cooker" will be completely equipped with non-aerated type burners. My British correspondent, who has actually seen the new model in use, feels very confident that its performance will not be found wanting. The top burner has a maximum consumption of 11,250 Btu's per hour and a minimum of 900 Btu's for simmering. The burner assembly is easy to keep clean. This is how the burner is described: "Over each burner is a circular plate designed to 'scrub' the products of combustion. The products impinge at speed on the perimeter of the base of the cooking utensil, evaporating condensate at the base edge and forming a blanket around the sides of the vessel. Heating is thus primarily through conduction through the plate, and partly through contact with hot products of combustion. With a vessel in position, the heating plate functions at a comparatively low temperature. If the burner is allowed to remain alight without a cooking utensil in position, the temperature of the plate will build up to over 1000° F., but the plate is so isolated that the solid section surrounding the hotplate remains only just warm to the touch. There is no flame impingement on the enamelled surfaces . . . The burner cocks are of special design incorporating dry seal ports . . . The non-aerated gas burners are thoroughly protected from accidental damage, and are so positioned within the combustion chamber that spill-over cannot extinguish the flames or foul the burners in any way. The spill-over is collected on a loose crown tray."

There is considerable secrecy, I feel, surrounding our own range manufacturers' intentions, or, at least, I must confess that I do not enjoy access to anybody's confidential files. Probably there is an American 100 per cent primary air burner gas range under wraps awaiting Hitler's overdue demise. I hope so.

The address of the British manufacturer whose enterprise is praiseworthy is Cannon Iron Foundries, Ltd., Bilston, Staffs., and I am sure full information will be forthcoming to any reader who feels prompted to ask—and at the same time congratulate—this pioneer in the field.

Air-conditioning

The August heat, which blanketed most of the United States, was particularly trying in our neck of the woods. Or was it the humidity? Anyway, it made me quite air-conditioning-conscious, so I wrote George Jones of Servel to bring me up-to-date. John A. Gilbreath, of the Air-Conditioning division, handsomely obliged, and I found the reading matter he sent very interesting indeed. Not that I am now the best posted man on air-conditioning in the industry, mind you, but I am enthusiastic enough to believe that it looks like a jolly good shovel to start filling in that summer valley, which has so long plagued our operators.

The gas and electric revenue figures are something. They prompted me to dig out my well-worn copy of Report No. 3 of the A.G.A. Postwar Planning Committee. That is the one summarizing the committee's work to date with "recommendations" to the industry.

"Recommendation No. 9" was my objective. It reads, in part: "Both the gas and electric industries *are recognizing* (my italics) that there are definite fields wherein each service is complementary, or best, and that the combination of services can be to the interest of both the consumer and the utilities.

"The fact that a combination of the two services can enable a higher standard of living to be achieved has not been appreciated by the American public."

The so-called combination company with both a gas and electric revenue from air-conditioning is sitting pretty. But who knows? We might even see the day when competing straight gas and electric companies are promoting the same air-conditioning equipment. In fact, from such a starting point, we might be able to work out mutually profitable programs whereby we will equip our ranges, water heaters, and heating equipment with electric pilots, signal lights, etc., if—is it too big an "if?"—the electric boys will meet us half-way in the cooking and heating fields, where they are hopelessly outclassed.

What About . . .

Hotel and Restaurant Appliances Postwar?

New England Gas Association Analysis Points the Way Toward Some Improvements

OF ALL the appliances analyzed by the Appliance Study Committee, hotel and restaurant appliances showed the greatest need for changes, improvements, development, research and new units. In an attempt to streamline these appliances, there has been a tendency to sacrifice sturdy construction and durability and to lighten and cheapen accessories such as door springs, hinges, etc. There is a need for sturdily and durably constructed food service appliances.

A "heavy-duty" appliance should be what the name implies. It should be built to withstand hard, long, continued use at high temperatures and rough handling. To prevent deterioration, all parts and materials in contact with the hot products of combustion should be treated or made of materials that will not corrode. An appliance should be constructed to stand the work which it will be called upon to perform, whether it be of a heavy-duty hotel line, a so-called "restaurant" line or cafe line of appliance. There is no place for inferior appliances in this field. They will do more harm than good. Quality—which includes sturdy construction, durability and long life—should always be a prerequisite.

There is a definite need for research and development in this field. This cannot be done wholly by the manufacturers. They may not always be able to do this work financially. In many instances, the sales volume would not be great enough to enable the manufacturer to spend the money to develop needed improved appliances. Some of the improved appliances developed recently by manufacturers have not been well promoted by many of the utilities. This lack of cooperation has discouraged and retarded the manufacturers from spending more money to develop badly needed appliances. This is particularly true of the smaller appliances.

The Committee hopes that the A.G.A. and the AGAEM will focus special attention on the appliance needs and utility sales promotion policies in the food service equipment field. It has been too long neglected. There has been a tendency to let the manufacturer and the dealer develop the appliances and, in many instances, let the dealer promote them. The gas industry should be placed in a better position to progress in this field.

In summary, the Committee hopes that:

1. The A.G.A. will set up minimum requirements for all food service appliances covering construction, performance and safety. There is a particular need for such minimum requirements for coffee urns and food warming tables. Such requirements will do much to improve the quality of the appliances and be a means of distinguishing between standard and non-approved equipment.

2. Ways and means will be found to institute at once needed research and development in this field—particularly for fryers, coffee urns and portable bake ovens.

3. The gas companies will promote aggressively the sale of all food service appliances including coffee urns, food warmers, gas-fired steam kettles and counter appliances. There is need for a more aggressive utility promotion in this field.

4. The gas companies will promote aggressively any newly developed and needed appliances, thereby encouraging the manufacturers to conduct further research.

5. Some manufacturers will have a complete line of all gas food service appliances for sale in the postwar period including ranges, broilers, fryers, bake ovens, toasters, steam kettles, coffee urns, food warmers, etc. This would provide a definite advantage which we do not now enjoy.

Ranges

The following remarks are intended to apply to all ranges of the hotel, heavy duty, restaurant and cafe lines—unless otherwise specified. In general the Committee hopes that:

1. Ranges will be developed with the heat deflected from the bottom of the range to permit safe installation on any type of floor.

2. A better finish will be developed for ranges that will stand up under long, continued, hard use and which will not deteriorate from the action of cooking acids.

3. All combination broiler and griddle units on ranges will be constructed so that they will perform both operations successfully.

4. A completely illustrated repair parts list will be provided by manufacturers on each model of equipment sold to facilitate ordering repair parts.

5. Durable name plates will be permanently attached to, and prominently displayed on, each appliance showing the model number, serial number, burner Btu. input,

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GAS PRESENTS herewith an excerpt from Part II of the report of the New England Gas Association's Appliance Study Committee dealing with commercial appliances. This section of the report was compiled by a subcommittee headed by HOWARD B. HALL and consisting of seven members of the main committee familiar with these appliances. Six hotel and restaurant specialists recommended by the chairman of the NEGA Industrial Division supported the committee.

Part II presents ideas covering possible gas appliance construction and operating improvements, which ideas have been developed through research, conferences and discussion meetings for many months by the NEGA Appliance Study Committee.

The NEGA directors have unanimously approved both Parts I and II which have been released to the AGA and AGAEM post-war planning committees; to the Institute of Gas Technology; to all regional gas associations; to all NEGA member gas companies; and to appropriate NEGA manufacturer member companies.

The purpose of the Committee's work has been to be helpful on the general objective of improving post-war gas appliances. The two parts of the report do not aim to be final nor ultimate, but simply to provide carefully considered ideas which may help to achieve the general objective—taken together with other similar studies made by other associations and by various gas companies and appliance manufacturers.

Chairman Wright of the Committee is a member of the AGA subcommittee on new and improved appliances and appropriate representatives of other regional associations are also members, thus giving a broad basis for the subcommittee's activities.

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etc., so as to be easily accessible and readable.

6. The height, depth and manifold sizes and locations will be of identical standards on all makes to permit easy interchange of units.

The Committee feels that it would be desirable if:

1. Doors could be placed on the high shelf of the range so that the shelf might be used as a warming compartment.

2. Research and development of a premixed air-gas combustion system for ranges and broilers were instituted.

3. Research and development were instituted on an external combustion system for bake ovens thermally controlled which provides recirculation of the products of combustion and/or cooking atmosphere to assure uniform heat distribution in the baking chambers.

Automatic Lighting: It is necessary that the AGA research project on automatic lighting will be extended to include hotel, restaurant and cafe ranges, with particular attention to oven lighting.

Burners and Oven Racks: It is hoped that:

1. Range oven burners will be supported in such a manner as to allow for sufficient expansion to prevent buckling and warping.

2. The design of the open-top range burners will provide for: (a) High efficiency and speed. (b) Flexibility for either heavy-duty or short-order work. (c) Protection from spillage to reduce the necessity for cleaning.

3. Two-piece burners will be eliminated or improved because of the difficulty in separating the two parts for cleaning and repairing. This refers to melting, warping and freezing of center inserts.

4. Burners will be constructed of high-heat-resistant ferrous alloys. (See subcommittee report on "Discussion of Material Used for Gas Burner Construction" under domestic ranges.)

5. Oven racks will be constructed to prevent warping or binding.

Doors: It is hoped that:

1. The complete door raising and lowering mechanism including springs, door hooks, quadrants, etc., will be: (a) More sturdily built; (b) Kept out of the heat zone; (c) Accessible for servicing.

2. Doors will be built to maintain oven tightness indefinitely to prevent heat leakage.

Flues: It is hoped that:

1. The flue will be so designed that the outlets cannot be blocked by utensils or by other means.

2. Provision will be made to prevent flue stoppage caused by scale from the interior of the flue or shelves, grease seepage from the range, or condensed oven vapors. (The use of stainless steel or some other corrision-resisting material might be considered.)

3. The Committee also feels that it would be desirable if an access panel were placed in the front of the back shelf to assist in servicing the flue.

Gas Cocks: The Committee feels that it is necessary that:

1. Ranges will be equipped with cock handles which are unbreakable and have a low heat conductivity.

2. Steps will be taken to prevent the "freezing" of gas cocks by removing them from the heat zone, eliminating heat leakage from the oven door and/or by other means.

3. Some fool-proof and positive identification will be made between oven cocks and top burner cocks.

Oven Bottoms: The Committee hopes that oven bottoms will be constructed of heat resistant, ferrous alloys to prevent warping when subjected to combustion chamber temperatures.

Range Tops: The Committee hopes that:

1. Closed tops on ranges will be made of some high-heat-resistant alloy, particularly the rings and covers, for greater durability and longer life.

2. The top grates will be built to provide greater durability and longer life.

3. Provision will be made to prevent grease from seeping through the range to eliminate insulation breakdown, stopped flues and other service troubles.

4. All burner trays will be constructed to catch all grease spillover.

5. Grease drains on griddles and fry tops will be constructed to handle adequately any amount of grease possible under any operating conditions.

Servicing: The Committee hopes that:

1. All manifold covers will be easily removable.

2. Burner cocks, orifices, etc., will be so arranged and designed as to be easily adjustable without the use of special tools.

3. Appliance parts will be fastened to the stove so that they can be removed without the difficulty sometimes created by corroded bolts and nuts.

Thermostats: The Committee hopes that:

1. Thermostats will be better and more sturdily constructed to withstand long, hard use. It is recognized that, in the present state of development, the rod-and-tube type of thermostat is superior to the liquid- or gas-filled type.

2. Thermostats will be located out of the heat zone or protected from it.

3. The dial will be made of unbreakable material with low heat conductivity.

4. The Committee also feels that it would be desirable if the thermostat dial face were larger, easier to read and had a longer calibration scale to facilitate more accurate setting and to promote greater use of the thermostat.

Deep Fat Fryers

The Committee hopes that:

1. Kettles will be constructed to insure longer life, particularly in the bond between the tubes and the kettle.

2. Thermostats will be better and more sturdily constructed to withstand long, hard use.

3. Fryers will have a faster recovery of the previous temperature of the grease immediately after the immersion of the food.

4. A drain valve will be developed that will stay tight.

Broilers

The Committee hopes that:

1. It will be possible to remove the burners without disturbing pilot assembly or other gas connections.

2. Primary air ports will be located to prevent entrainment of grease vapors which tend to clog the air ports. (The type where the disc air shutter turns on the threaded orifice holder for adjustments aids in the entrapment of grease.)

3. Cocks will be sturdily constructed, equipped with unbreakable handles with low heat conductivity.

4. The raising and lowering device on broilers will be so constructed that it will operate with a minimum of effort. This would reduce the breakage of broiler parts and increase the flexibility of broiling.

(A crank-and-worm gear assembly might be a possibility.)

5. Burners will be designed to withstand continued high temperatures to eliminate warping and clogging. (The use of high-heat-resistant ferrous alloys might correct this.)

6. The Committee feels also that it would be desirable if a broiler capable of broiling both sides of an article of food at the same time were developed.

Bake Ovens

The Committee hopes that:

1. Bake ovens will be equipped with thermostats of heavy construction. It is recognized that, in the present state of development, the rod-and-tube type of thermostat is superior to the liquid- or gas-filled type.

2. High-heat-resistant ferrous alloys will be used in the construction of burners and oven bottoms.

3. Some automatic method to secure greater temperature uniformity in all parts of the baking chambers of portable cabinet ovens will be devised and applied to these ovens.

4. The AGA research project on pilot ignition will be extended to bake ovens, with particular attention to oven lighting.

Miscellaneous Counter Appliances

The Committee hopes that:

1. All short-order stoves will be improved in appearance and construction with concealed manifolds and will be equipped with burners, valves, valve handles, thermostats and pilots of the type and kind suggested for ranges.

2. If a short-order stove includes a combination broiler and griddle, it will be so constructed that it will perform both operations successfully.

3. Miscellaneous counter equipment will be so designed as to be servicable from the front, as adjacent appliances may make servicing from the side impossible without disconnection.

Toasters

The Committee feels that there is a definite need for a pop-up type of toaster and endorses the research work being conducted on this project by the AGA.

New Devices

The Committee feels that it would be advisable if:

1. A thermally controlled, dry-heat, plate warmer were built.

2. A satisfactory gas-heated roll warmer were developed.

3. A small, high-temperature (210°F) water heater were built to replace water urns for coffee making.

4. Receptacle outlets and non-kinkable flexible connectors were used for counter appliances. (See the subcommittee report on this subject under domestic ranges.)

5. An efficient and durable dish or glass sterilizer were developed.

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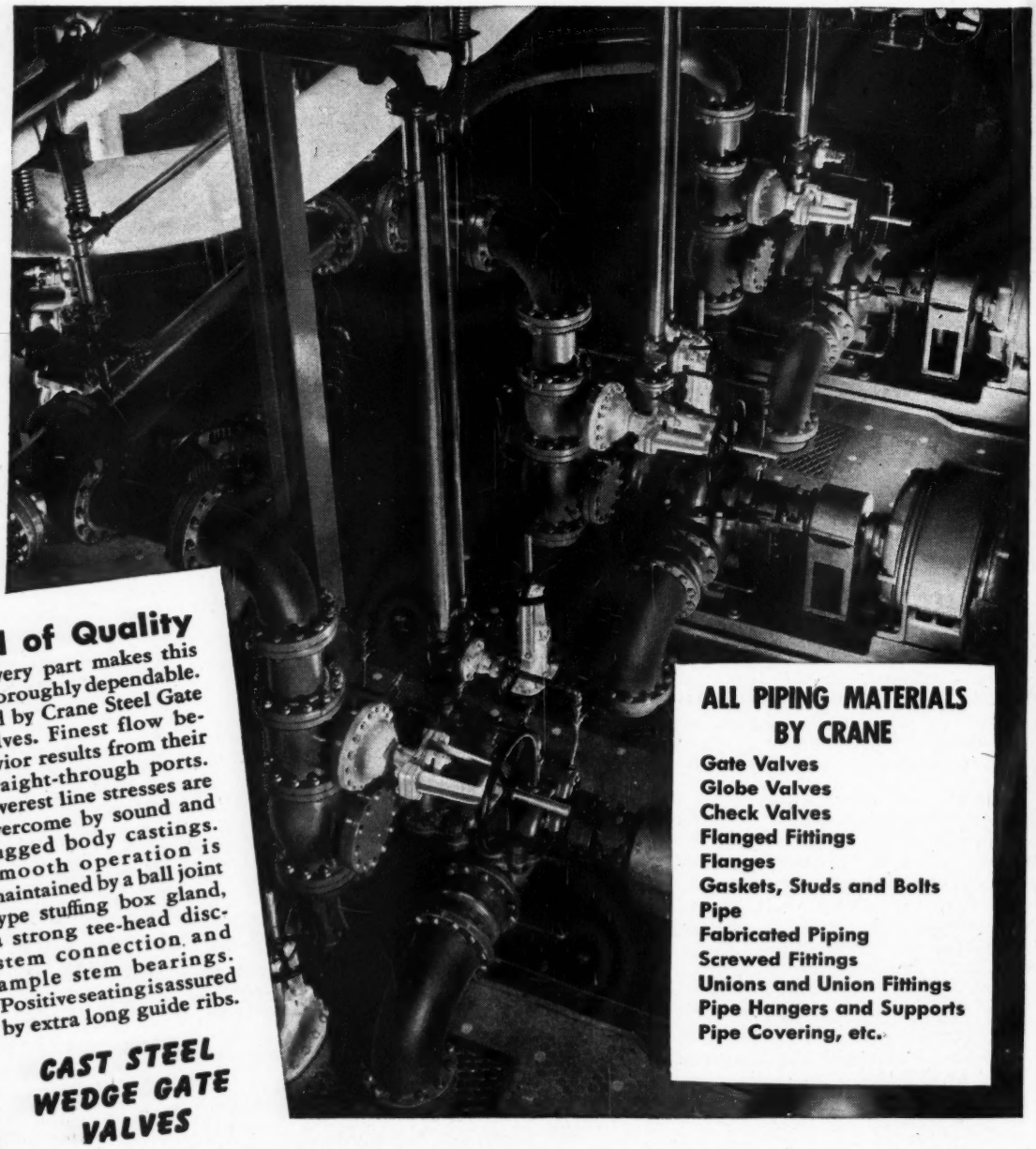

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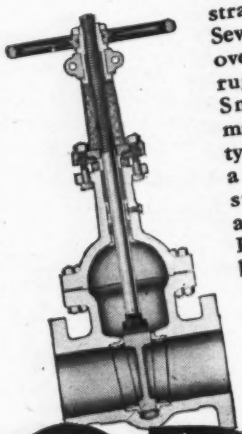
Adequate quality in every part makes this entire piping system thoroughly dependable. Such quality is typified by Crane Steel Gate Valves. Finest flow behavior results from their straight-through ports. Severest line stresses are overcome by sound and rugged body castings. Smooth operation is maintained by a ball joint type stuffing box gland, a strong tee-head disc-stem connection and ample stem bearings. Positive seating is assured by extra long guide ribs.



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S. D. Colvin, the "daddy" of the experiment. His only automobile expense, other than natural gas used, during one month was $4.33 for tire repairs. He drove 928 miles during that period.

There's Always Gas in This Pick-up

By S. D. COLVIN

Industrial Engineer,
Southern Union Gas Co.,
Santa Fe, New Mexico

THE "All-Purpose" Fuel—that's Natural Gas. Not only does it cook, heat water, refrigerate, and warm homes and buildings, but now it's subbing for gasoline as a fuel for automobile motors.

Gasoline rationing doesn't bother us here in Santa Fe. We are all set for the time when there is not a sufficient supply of gasoline to operate our company cars and trucks. We now have one of our Ford pick-up trucks equipped to burn natural gas. We find that it takes 8 cu. ft. of natural gas per mile, driving the pick-up around town, and 6 cu. ft. per mile driving on the highway at a speed of 35 miles per hour.

The equipment used in making this installation consists of a 45 gal. Ruud Water Heater tank, placed crosswise in the bed of the pick-up, just back of the cab. The tank is 18 in. in diameter and holds 105 cu. ft. of gas with 200 lbs. pressure. There are two regulators mounted on the tank, one cuts from 200 lbs. to 50 lbs.; the other cuts from 50 lbs. to 4 oz. A piece of aluminum tubing, such as is used to connect up ranges, is used to convey the gas to the carburetor.

The gas carburetor is made of a short piece of 2½ in. pipe reamed out to fit on the gasoline carburetor where the air-cleaner was. A short piece of 3/8 in. pipe is screwed through the 2½ in. pipe with a draft-actuated valve in the center of the 2½ in. pipe. This valve feeds the gas in proportion to the air, which is drawn into the motor, and also acts as an automatic shut-off when the motor stops.

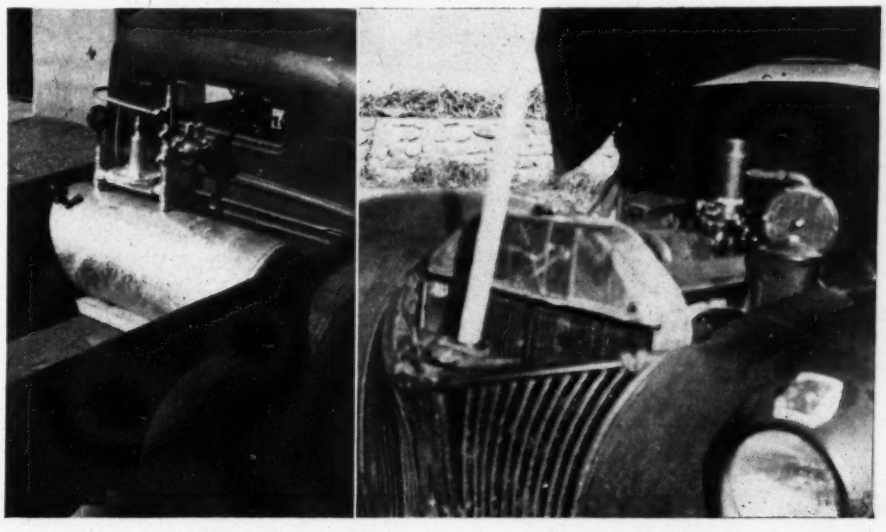
The gasoline carburetor is left on the car. The only change necessary is to install a small valve in the gasoline line, between the fuel pump and the carburetor. This valve is closed and the carburetor allowed to run dry of gasoline before the natural gas is turned on. To switch back to gasoline for fuel, this action is reversed. It only requires 30 seconds to change from one fuel to the other.

The motor runs just as well on natural gas as it does on gasoline. The use of natural gas as a fuel will not cause carbon to form, nor will it dilute the oil in the crank case as does the use of gasoline.

At present, we are filling the tank at our Santa Fe Border Station, where there is around 200 lb. pressure. If it ever becomes necessary for us to convert all of our cars to the use of natural gas, we will install a storage tank near the warehouse and compress the gas up to around 500 lbs., which would allow us to fill the tanks on the cars with natural gas at approximately 400 lbs. pressure. This would give a sufficient amount of natural gas to run the average pick-up all day.

Plan Conversion Plant to Use Synthetic Oil in Kansas

Plans to build a conversion plant in Kansas, to utilize natural gas from the Hugoton field of Oklahoma and Kansas for the production of synthetic oil, have been started with the purchase of 100,000 acres of Hugoton leases, Fred C. Koch, consulting engineer, announced at Wichita, Kans. The plant, plans for which are still in a formative state, will be operated under the Fischer-Tropsch process. If built, it will be the first of its kind in Kansas. Theodore A. Morgan, conservation director of the Kansas Corporation Commission, said that the Champlin Refining Co., had "tentatively agreed to go into the project."



AT LEFT: Natural Gas storage tank and regulators (lower left) mounted on company's Ford pick-up, Santa Fe, New Mexico. AT RIGHT: The natural gas carburetor and automatic cut-off mounted in place of air cleaner on regular gasoline carburetor.

Now available . . .
Rheem Arrowhead
Automatic Gas
Water Heater

Some Recommendations for

POSTWAR DOMESTIC GAS APPLIANCES

Highlights from P. C. G. A's. Postwar Appliance Committee Report

THE Pacific Coast Gas Association's committee on postwar domestic gas appliances has been active for nearly two years. Its final report has just been submitted to the Committee for Gas Industry Development. This paper is designed to touch upon some of the highlights of the material covered.

The committee developed its specific recommendations for postwar gas appliances through five special working groups within the committee (ranges, water heaters, refrigerators, heating equipment, and accessories and controls; the results of the latter being incorporated finally in those of the other four). These recommendations are to be printed and distributed soon in manual form.

Post-war gas appliances should comply with, but not be limited by, A.S.A. approval requirements. Further, the committee urges careful study of the research bulletins of the A.G.A. Testing Laboratory on domestic gas range and water heater research, and domestic gas burner research, and all other related available information. Particular significance is attached to developments of 100% primary air burners.

Ranges

The design and appearance of postwar ranges is of utmost importance, in view of modern concepts of kitchen design and styling. Flush-to-wall and flush-to-floor designs are urged, with provisions to facilitate installation and disconnection.

Ranges to meet customer needs on the Pacific Coast will apparently be larger than those recommended nationally. A width of from 38 to 42 in., depth of not more than 28 in., and work surface height of 36 in. are recommended.

Cleanability is given great emphasis. Flat, smooth surfaces, absence of cracks, exposed screws, etc., large radius bends, are all recommended. The top section should be so attractive in appearance that lift covers are unnecessary. The recommendations include specifications for finishes to conform with the cleanliness and cleanability requirement and to withstand normal use without damage. Burners must be protected from boil-overs.

White is the color recommended wherever possible. If black is used, as on wiped surfaces, its appearance should be reduced to a minimum.

Materially reduced surface temperatures is considered important. The recommendations give specific comments on accomplishing this.

Burners, Griddles, Cookers: Improved heat distribution of top burner-grate combinations is emphasized. Hot spots in simmer burner operation must be avoided.

All top burners should be equipped with effective automatic ignition and the burner controls located to avoid necessity of reaching over any burners to operate. The committee suggests study of top burners automatically controlled by thermostat, or turned down automatically from rated input to simmer, and then off with a time control, as a possible means of minimizing the effort and watching of cooking operations and adjusting burners for top section cooking.

Examples are offered of top burner grate arrangements to provide more room, eliminating overlapping of large pans, providing adequate working space, and eliminating tipping of pans.

Several recommendations are made concerning improvement of griddles, from the angle of appearance, cleanability, grease disposal, and uniformity of temperature.

While considerable demand among women for deep well cookers is recognized, it is suggested that this be met by supplying streamlined cooking pot of deep well type, as an accessory to avoid sacrificing top burner space. However, specific recommendations are offered for deep well cookers if built in as a recessed portion of the top section.

Ovens: Cleanability and improved finish of ovens is emphasized.

Sixteen inches is considered a minimum width, and the height should be sufficient to permit satisfactory completion of any baking operation when performed on both racks at the same time. Ovens larger than contemporary standards are recommended.

Quiet and smoothly operating, tightly fitting oven doors are important.

W. M. Jacobs

W. M. JACOBS received the gold medal award at the Pacific Coast Gas Association annual meeting in Los Angeles last month on behalf of the Association's Postwar Appliance Committee of which he is chairman. Herewith presented are excerpts from an address given by Mr. Jacobs before the Sales and Advertising Section of the Association at the Ambassador Hotel in Los Angeles, Sept. 14. Mr. Jacobs, general manager of sales for Southern California Gas Co., has attained a nationwide reputation as a sales planner and organizer. He has served A.G.A. as chairman of the Copy Committee under the National Advertising program and next year is slated to lead the Sales sand Advertising Section of PCGA.

Springs are given detailed comment for accessibility for servicing.

Oven racks should be improved mechanically.

Hot spots should be eliminated and surface temperatures further reduced.

Oven heat distribution should be even for all normal cooking temperature settings; it is suggested that this might be accomplished with one oven burner to maintain the temperature and a second to augment it during the heat-up periods.

The oven temperature should not be increased as a result of pilot operation alone.

Range ovens should be equipped with effective automatic ignition and automatic clock oven control should be given still greater emphasis in manufacturing and selling plans.

Glass windows high in the oven door are suggested as optional features, because of the recorded desire of many women to watch food cooking or baking. An oven light is recommended at least in conjunction with glass oven doors.

Broilers: Elevated broilers are recommended, particularly in table top models. When not so provided, however, operation of the broiler section of the range should be made independent of the oven operation; i.e., the broiler operation should not be limited by action of the thermostat.

Because of the high susceptibilty of the broiler to hard-to-clean splatters, it is imperative that it be made easy to clean. The recommendations include specific requirements and suggestions to accomplish this. It is recognized that the broiler is an outstanding feature of the gas range, and that no other method of broiling can equal the gas broiling operation. To effectuate further improvement, the broiler should be capable of attaining a high temperature within a short time. A "flash" type is suggested, or one that will satisfactorily brown moderately thin meat slices (1/2 to 3/4 in.) leaving the center rare.

Broiler doors should fit tightly without leakage and it is important that they operate smoothly and without noise when hot or cold. Racks, grids, and pans should operate smoothly and quietly regardless of temperature, and should not distort due to quick change in temperature. Range broilers should be equipped with effective quick automatic ignition.

Control: Specific and detailed recommendations are included concerning controls and accessories, with emphasis on precision of performance, and service accessibility.

Manufacturers should investigate the possibility of using a two-stage control system that will provide a sufficient input for speed preheating but will also provide a minimum input not exceeding 5000 Btu. per cu. ft. of oven volume. New methods for positive identification of the number of certain definite inputs for burners are recommended, so that the user will not be required to adjust the burner by observation

of the flame, but can duplicate previous results. Flexibility between positions is also important.

If and when single point gas ignition is developed to a point of being feasible in first cost and dependable and foolproof in operation, it is considered preferable to electric or multiple point gas ignition.

Operation of full automatic clock controls should be simplified, so that there will be no confusion in the mind of the user.

While the question of filters for range oven pilots was given detailed consideration, this was concluded to be a general industry problem now under active consideration, and not a matter of appliance design alone.

Refrigerators

The committee has assumed that the refrigerator manufacturer is abreast of recent developments in new materials which can improve appearance, performance and price, and will use them as appropriate consistent with strength and durability. No reference is therefore made in the recommendations to new types of materials.

It is urged that every possible effort be made to reduce selling prices to the end that we can be more competitive with electric refrigerators than in the past.

There has been interest in Southern California in a counter type refrigerator for postwar new homes.

The appearance of the refrigerator must follow current style trends and be competitively abreast. The grilled vent should be maintained as inconspicuously as possible but so constructed that combustion products and warm air be deflected forward from the wall as much as possible.

The dimensions of recent models are considered generally satisfactory. If any changes are made, they should be in the direction of decreasing depth and increasing width.

Specific suggestion is offered for improving the method of holding shelves to give greater flexibility in the use of the interior.

A more satisfactory and durable ice cube release and trigger tray arrangement is needed.

Ample space for the storage of frozen foods is considered important.

Comment is offered for improving defrosting controls.

Maintenance of high humidity in the food storage compartments is a definite necessity.

Specific comment is included for mechanical means for leveling.

It is essential that design features prevent circulated air currents from wiping walls or ceilings; wall discoloration is a problem to all types of domestic refrigerators.

Automatic Storage Water Heaters

In recognition of the extensive problem of short tank life in most areas of the Pacific Coast, serious consideration by manufacturers of the factors prolonging tank life in service is urged.

It is also recommended that manufacturers particularly study comparative advantages and overall field performance of full floating vs. internal flue types of tanks, and emphasize that type which proves to be the better (reference to AGA research bulletin No. 19).

Water heaters should be designed for installation flush to the wall and floor, preferably for corner locations.

The heater as completely installed should present a neat and attractive appearance. Consideration should be given to concealing the draft hood within the heater as installed.

Piping connections and mechanical parts to be concealed behind removable panels, but, together with controls and accessories, should be readily accessible from the front of the heater.

Twenty gallons is considered a minimum actual storage capacity of any storage water heater.

The hourly recovery capacity should not be less than 40 gal. per hour.

Consideration should be given to novel means of heat transfer to avoid local overfiring and minimize rate of accumulation of lime; an example, multi-tube construction.

The recommendations encourage design of supplementary booster heaters for higher water temperatures to supply home laundries, dishwashers, etc.

Detailed recommendations are given concerning draw-off characteristics, tank features, burners, and controls and accessories. Design to minimize service requirements is emphasized.

House Heating Appliances

These recommendations are somewhat more generalized, stating, in part, general objectives of ideal heating systems. Even temperatures, elimination of cold floors and noticeable drafts, elimination of wall discoloration, elimination of expansion and contraction noises. and facilitation of the starting up of heating appliances by the consumer are emphasized.

It is suggested that consideration be given to the basic fundamentals involved in comfort heating, such as the relative intensities of heat from different types of heating appliances and heating means, as related to human comfort. Greater emphasis should be given to designs of heating means which will yield a mild, even heat distribution, as contrasted with concentrated sources of heat at high temperature.

While it is recognized that non-vented heating appliances have been and are still important gas consuming devices and when properly and carefully manufactured, installed, and used, have satisfactorily served their purpose, it is felt there should be an increasing trend toward universal application of venting to all house heating appliances. Special emphasis should be given to having properly vented heating equipment incorporated in the original plan and construction of each building.

Appearance and sales appeal should be given more emphasis in design. The appearance and reality of sturdiness to avoid adverse customer impression of "tinny" furnaces require attention.

Specific recommendations are made concerning factors affecting installation.

Fully automatic, safe, and reliable ignition from cold start is recommended to eliminate the need for gas company seasonal "starting" service.

Controls to eliminate alternations or intermittent operations and produce a smooth, even, overall effect are recommended.

Emphasis should be placed on control of comfort within each individual room and within closer limits than have been attained in the past, as for example with zone heating or with other means producing similar results.

Design and capacity of equipment for use on the Pacific Coast should take account of the general practice of daily re-heating of the home, with the house completely cooled off during the night.

Specific recommendations are included concerning service accessibility, accessories and controls, and markings and instructions.

Pittsburgh War Workers Pack Vitamin Lunches

The GI Joes of industry are finding out what to take in a lunchbox to keep fit for their war plant jobs.

According to Miss Flora G. Dowler, home service director of the Manufacturers' Light and Heat Co. and affiliated gas companies in Pittsburgh, this is an expanding part—but only a part—of the wartime home service job her girls are carrying on through their territories.

In several districts, a real start has been made in lunchbox demonstrations among the men and women workers, who have shown deep interest. In one area a total of 19 industrial plants have been served. Many of these are war plants, some are glass plants and others not directly connected with the war effort. But in all cases there has been a valuable educational job showing workers how to make the noon lunchbox—or midnight, for that matter—an integral part of the whole day's menu—that lunchboxes should contain foods which will give the right amount of proteins, vitamins, minerals for good health, good teeth, good bones, good muscles.

"Most workers," says Miss Dowler, "are surprised to be told that they are not eating the right foods. They do not feel ill-fed, because they are making good money and can buy what they want. But when they learn that the fact they feel out of sorts, or tired, or are actually ill is due to improper feeding, they soon wake up and begin demanding that their womenfolk pack a lunch a man can work on. As for the girls, it has definitely ended the chocolate eclair type of lunch or the fast snack in which there are practically none of the food elements they need."

Chickasha Gas Segregated

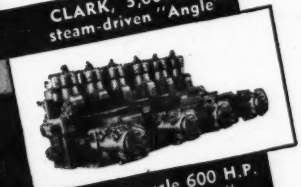
The Oklahoma Corporation Commission has ordered that natural gas produced from the lower Charlson zone, Chickasha field, Grady county, Okla., must be segregated from all other sources of supply.

Purpose of the order is to prevent this gas from comingling with gas from any other source of supply.

2-CYCLE FOR *Continuous* POWER

SIMPLE PORTS
instead of moving valves mean
SUSTAINED Fuel Economy!

CLARK, 3,000 H.P. steam-driven "Angle"



CLARK, 2-cycle 600 H.P. gas-driven "Angle"

Moving valves, for intake and exhaust, deteriorate and allow fuel leakage. Thus, in 4-cycle engines, initial fuel economy is not maintained.

In 2-cycle engines, however, simple ports handle intake and exhaust and cannot deteriorate! Thus, in the 2-cycle, initial fuel economy endures for the life of the engine!

The CLARK Super-2-cycle "Angle" offers you sustained fuel economy .. and a new low in fuel consumption.

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CLARK SETS THE PACE IN COMPRESSOR PROGRESS

CORROSION AND PROTECTION

Of Buried Metallic Structures

Compiled and Abstracted by GUY CORFIELD, Technical Editor, GAS

4. Cathodic Protection, Theory and Research

Behavior of Zinc-Iron Couples in Carbonate Soil

T. H. GILBERT and GUY CORFIELD, Southern California Gas Co., Los Angeles. **Excerpts from a paper, "The Behavior of Zinc-Iron Couples in Carbonate Soil," presented before the U. S. Bureau of Standards Fifth Soil Corrosion Conference, Saint Louis, Mo. This is the first paper in a series of three which will be published under the general heading, "Cathodic Protection, Theory and Research."**

THE behavior of zinc in electrolytic contact with steel in various types of soils has become important from the standpoint of the cathodic protection of pipelines. In order to determine the conditions under which this type of protection may be effective, zinc-iron couples in various area ratios were recently buried at several test sites by the U. S. Bureau of Standards.

One of these test sites is a "high carbonate" soil near Los Angeles. Tests of the soil at this site gave the following results:

Total soluble matter*	0.138%
Chlorides, Cl	0.003
Carbonates, HCO_3	0.015
Bicarbonates, HCO_3	0.102
Sulphates, SO_4	0.010
pH	9.18
Resistivity, ohm/cm., Shepard Rod	2,550
Corrosivity index (nipple and can, 2 volts)	0.5

*Per cent by weight on air dry basis.

Installation was made in September, 1941, and the couples were removed in March, 1943. Each couple consisted of an iron ring connected to one or more zinc cylinders and arranged as shown in Fig. 1. The entire surfaces of the iron rings were in contact with the soil. The zinc cylinders were surrounded by bottomless glass jars so that only their bases made soil contact. When installed, the area of each iron ring was 48 sq. in. and the area of the bottom of each cylinder was 2.4 sq. in.

Fig. 2 shows the current flow in the couple circuit from the time of installation to the last inspection. There seems to be no very definite trend of the data over long periods. However, for approximately the first six months, the group of three anodes furnished three times the current furnished by the single anode, indicating that the cathodes were not polarized. It is also noticed that after approximately 3½ months, two anodes furnished as much current as three anodes for an interval of three months. At this time the current gradually decreased until it reached and maintained a value lower than the current furnished by the single anode. Shortly after the current furnished by two anodes began to decrease, the current furnished by three anodes also began to decrease, and on February 11, 1943, this current was the lowest of the three couples, with the single anode furnishing the most current.

In order to obtain the correct current values when taking current readings, a "zero-volt-loss" circuit was constructed and used with a multimeter in all tests. This was necessary because any meter resistance in the circuit reduces the output of the couples so that the correct value is not read on the scale. The "zero-volt-loss" circuit, which is shown in Fig. 3. is a modification of the circuit used by I. A. Denison and R. B. Darnielle in conducting preliminary laboratory tests for the Bureau of Standards. A range selector, with four positions (see Fig. 3), is provided in order to make it possible to balance the circuit quickly when using any scale on the multimeter from 1 milliampere to 1000 milliamperes. R_1 and R_2 provide a means of obtaining a coarse and a fine resistance adjustment. When using this circuit, the current is affected only by the resistance of the leads between the source and the galvanometer, and in most cases the lead resistance is so low as to be

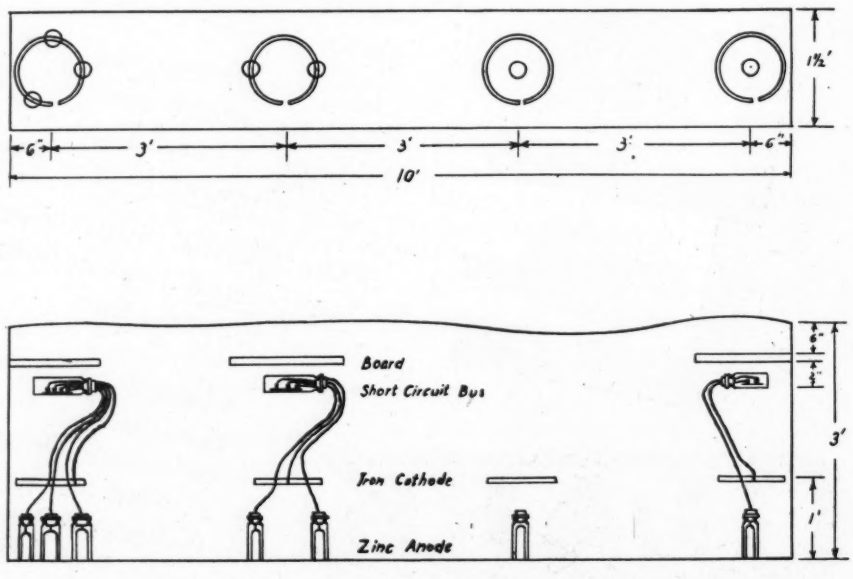


FIG. 1. Arrangement of zinc-iron couples.

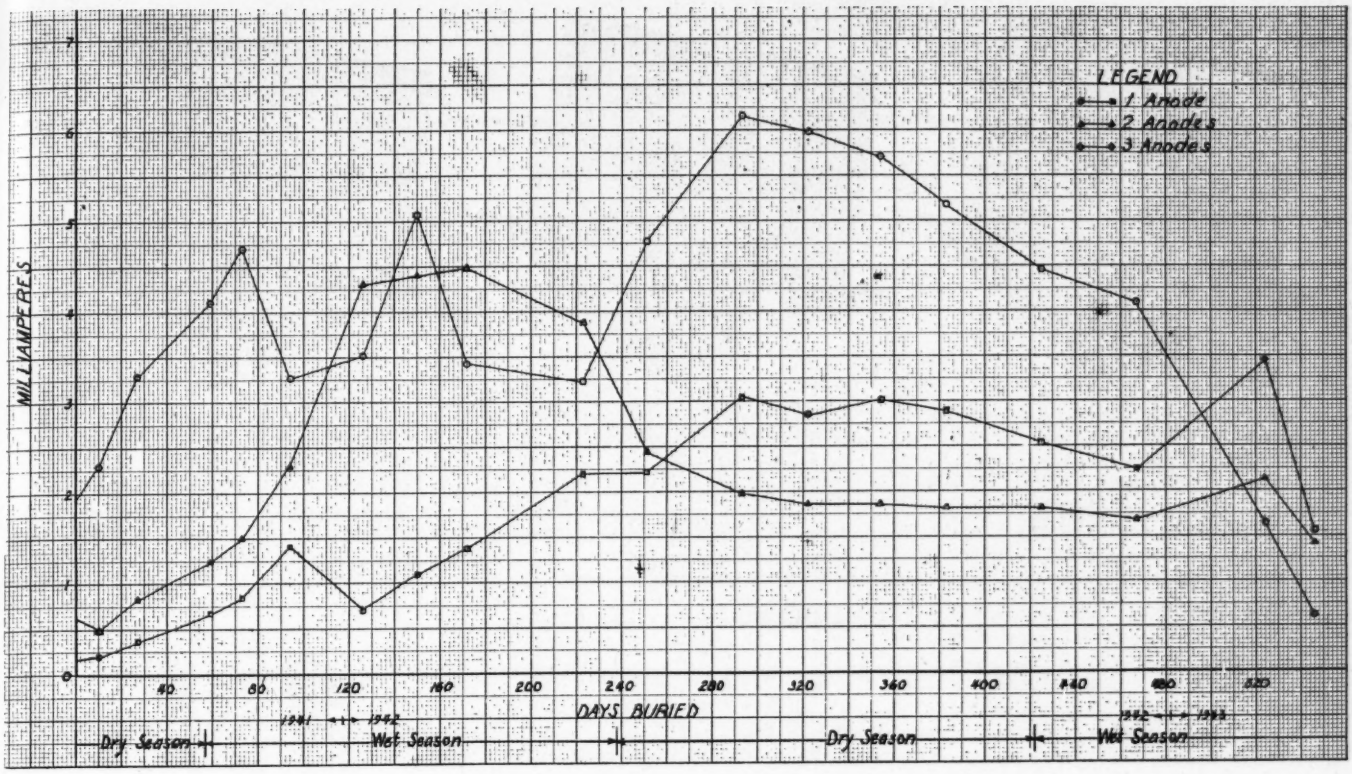


FIG. 2. Current in zinc-iron couple circuits, carbonate soil near Los Angeles.

Table I

Specimen	Initial Weight Grams	Final Weight Grams	Loss of Weight Grams	Loss of Weight Per Cent	Max. Pit Depth in.	Current Density in Milliamperes per sq.ft. Initial	Final	Maximum	Remarks
Cathode No. 21	803.695	757.800	45.895	5.710	0.070	-	-	-	No deposit
Anode No. 36	1023.515	1023.140	0.375	0.037	-	-	-	-	on anode.
Cathode No. 22	807.418	780.120	27.298	3.380	0.078	0.480	4.65	9.750	Max. depth of coating
Anode No. 37	1021.895	988.110	33.785	3.300	-	-	-	-	on base of anode equals 0.135".
Cathode No. 23	807.198	790.110	17.088	2.150	0.035	2.025	4.26	13.500	Max. depth of coating
Anode No. 38	1018.632	1002.440	16.192	1.590	-	-	-	-	on base of anode:
Anode No. 39	1022.838	999.940	22.898	2.235	-	-	-	-	No. 38 = 0.069"
									No. 39 = 0.175"
Cathode No. 24	801.945	786.670	15.275	1.902	0.041	5.730	1.86	18.450	Max. depth of coating
Anode No. 40	1020.298	988.670	31.628	3.100	-	-	-	-	on base of anode:
Anode No. 41	1023.582	1008.660	14.922	1.458	-	-	-	-	No. 40 = 0.175"
Anode No. 42	1019.188	992.900	26.288	2.580	-	-	-	-	No. 41 = 0.100"
									No. 42 = 0.200"

Key to Zinc Anode and Iron Cathode Numbers
Numbers 21 and 36 Unattached.
Numbers 22 and 37 Connected together electrically.
Numbers 23, 38 and 39 Connected together electrically.
Numbers 24, 40, 41, and 42 Connected together electrically.

Analysis of Zinc used in casting anodes in foundry.
Pb 0.007
Fe 0.005
Cd 0.005
Al 0.000

negligible. The resistance of the leads used in these tests was 0.36 ohm.

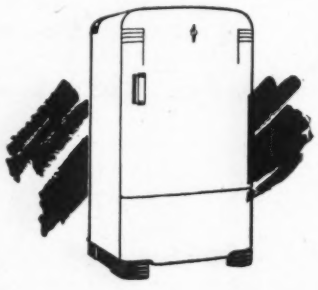
Potentials of the iron rings and zinc cylinders with respect to a copper sulfate electrode, after the circuits had been disconnected and left open for approximately one-half hour, were taken with a Yeeds and Northrup potentiometer. After the first inspection, no appreciable change in the potential of the anode with time was observed, the value staying practically constant at 1.00 volts. The potentials of the iron rings ranged from 0.35 volt to 0.79 volt. These variations are of interest because they indicate the unreliability of iron as reference electrodes.

The difference of potential between the zinc anodes and the iron cathodes, after the circuits had been disconnected and left open for approximately one-half hour, were also taken with the Leeds and Northrup potentiometer. A rather wide variation of potentials was noted, from 0.2 to 0.68 volts. There seemed to be a rough correlation between these potential differences and the wet and dry seasons in this locality. It was noticed that, in general, the open circuit voltages were highest during the period from May to November, the

Preparing for post-war Gas Refrigeration with . . . New Features

In cooperation with the Gas Industry, Servel is preparing now to put into full operation the day war ends a program with two objectives: 1. Through the manufacture and sale of both new and improved Gas Appliances to help Gas Companies maintain and build their loads. 2. Through the distribution and sale of such units to provide new jobs for war workers and service men.

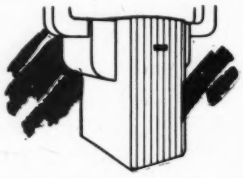
Naturally, a large part of this program will revolve around the manufacture and sale of Gas Refrigeration. The Servel Gas Refrigerator has always been a product that Gas Companies could proudly sell. But Servel engineers are continually working to improve the Gas Refrigerator's performance. New refinements, new features are being developed for storage space . . . convenience . . . performance.



Building for new future business with . . . All-Year Gas Air Conditioning

All-Year Gas Air Conditioning is also a vital part of Servel's post-war program. Here "action now" takes form at Servel's schools.

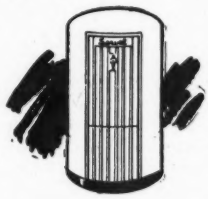
With these schools now nearing completion, trained and experienced personnel will be available in local Gas Companies to build sound air conditioning organizations, ready to help promote sales effort the day product is available.



Reaching architects and builders with . . . Business Magazine Campaigns

The men who specify and install Gas Appliances and Equipment will be a big factor in post-war sales. Servel is telling these men—architects . . . contractors . . . engineers . . . and realtors—about *All-Year* Gas Air Conditioning and Gas Refrigeration through the best-read publications in the field.

Paving the way to extra load with new Automatic Gas Water Heaters



Certified performance (C-P) Automatic Gas Water Heaters are a post-war certainty. In such a development, new and improved quality will be built in Automatic Gas Water Heaters, providing new standards of performance, service and operating costs.

The same high standards of engineering and production used in developing the Gas Refrigerator are now being applied to the creation of a line of unique Servel Automatic Gas Water Heaters for post-war distribution.

Soon, complete plans for advertising and promotion will be available to the industry.

SERVEL

TARGET FOR TOMORROW . . .

In the Planned Gas Kitchen of integrated design, our industry has a powerful vehicle which—if promoted aggressively and effectively—can match the best of the post-war competition in the battle of the fuels.

This All-Gas Kitchen with its integrated design provides a sales opportunity to maintain and protect existing gas load through a program of modernization in existing homes. It can be the means of adding considerable new load when effectively merchandised to builders and owners of new homes.

From the research laboratories of our industry will come some amazing new developments for the gas-served kitchen of tomorrow. Probably a complete unit adaptable to any kitchen—old or new—will be available soon after the war through the cooperative efforts of Gas Appliance manufacturers.

Servel's contribution to this important program will be announced soon and will include a comprehensive training and merchandising plan of action.

It will be designed to enable Gas Companies to take full advantage of the post-war trend toward *A New Quality of Living!*

SERVEL

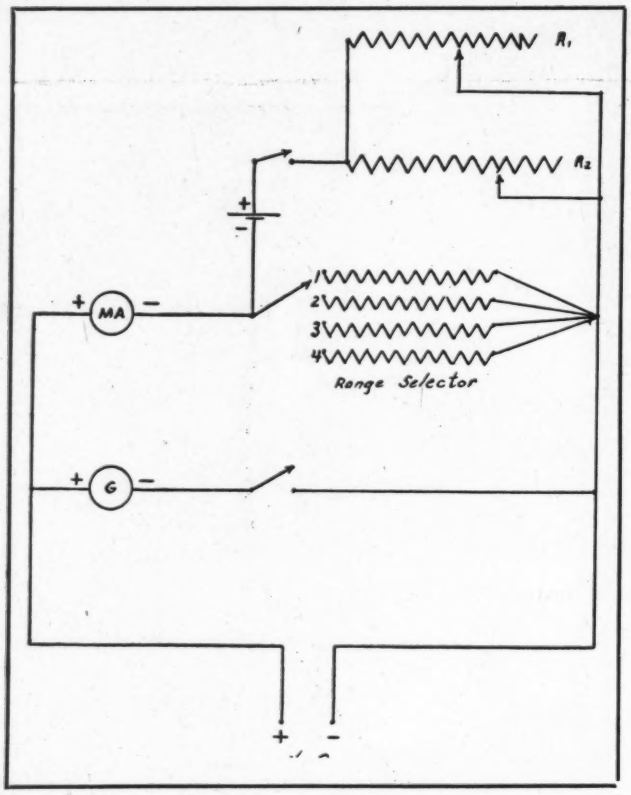


FIG. 3.

Wiring diagram "zero-volt-loss" milliameter circuit.

dry season, and, with the exception of the two anode installations, these voltages were much lower during the period from December through April, the wet season.

After the couples had been buried for 546 days, they were removed from the soil and the zinc anodes and iron cathodes were cleaned and weighed. The cathode rings were first wire-brushed and then cleaned by making them cathodes in a 2% sulphuric acid solution. A white deposit, varying in thickness from 0.069 to 0.2 in., was found on the base of every anode with the exception of the unattached anode. This deposit, presumably zinc carbonate, was scraped off for analysis, and the entire zinc cylinder was then wire-brushed.

Table 1 shows the results of this examination. Although no attempt has been made to analyze the data, it is apparent that none of the cathodes received adequate protection. It is also indicated that the coating formed on the anodes, when buried in a carbonate soil, reduces the current output to such an extent that no great advantage is gained by providing a large anode area.

Meter Course Ready for Distribution

THE "Meter Course," Publication No. 17, a notebook complete with index, published by Southern California Meter Association, is now ready for distribution and may be obtained at a cost of $3.50 by sending check or money order to George H. Forster, Jr., 2916 Eucalyptus Ave., Long Beach 6, Calif. Individual papers may be purchased for $.50 each. The Association also published a handbook of some 150 loose-leaf sheets available for $2.50 without binder, and $4.25 with binder. A summary of the "Meter Course" is as follows:

Paper No. 1

"Fundamental Gas Laws and Their Application to Orifice Metering"—Edgar Valvy, Richfield Oil Co.

"Fundamentals of Orifice Meter Measurement"—J. B. Taylor, Jr., Signal Oil & Gas Co.

Paper No. 2

"Calculations of Orifice Meter Coefficients for Natural Gas"—George H. Forster, Jr., Texas Co.

"Measurements of Flow of Fluids through Orifices with Particular Reference to the Measurement of Liquids and Steam"—Wm. L. Cowan, Union Oil Co. of Calif.

Paper No. 3

"Calculation of Orifice Meter Charts by the Hand Method"—Harry Faull, Southern Counties Gas Co.

"Calculation of Orifice Meter Charts by the Palnimeter Method"—J. T. Cortelyou, Southern California Gas Co.

"Calculation of Orifice Meter Charts by the Integrator Method"—W. J. Kennedy, Southern California Gas Co.

Paper No. 4

"Unit Coefficients for Orifice Meters"—T. K. M. Smith, Pacific Lighting Corp.

"Maintenance of Orifice Meter Plates and Tubes"—Walter Bostrom, General Petroleum Corp.

"Temperature Determinations in Orifice Meter Runs"—Mark McIlvaine, Chanslor Canfield Midway Oil Co.

"Orifice Meter Fittings"—Gurney B. Reece, Southern Counties Gas Co.

Paper No. 5

"Maintenance of Mercury Type Orifice Meters"—Melroy Welch, Barnsdall Oil Co.

Paper No. 6

"Bellows Type Gauges"—L. S. W. Des Brisay, Southern California Gas Co.

"Parabolic Bell-Type Mercury Gauge"—A. J. Norman, Southern California Gas Co.

"Taylor Bellows-Type Gauge"—Emerson L. Kumm, Dow Chemical Co.

Paper No. 7

"Fundamental Principles of Regulators"—Frank Renner, American Chart Co.

"Operation and Maintenance of Emco Regulators"—E. H. Adams, Pittsburgh Equitable Meter Co.

"Operation and Maintenance of Reliance Regulators"—W. Thrall, Reliance Regulator Co.

"Operation and Maintenance of Mason-Neilan Regulators"—F. Mason, Mason-Neilan Regulator Co.

Paper No. 8

"Fundamentals of Controller Equipment"—Curtis Cortelyou, General Petroleum Co.

"Telemetering and Remote Control"—H. J. Keeling, Southern Counties Gas Co.

Paper No. 9

"The More Common Methods of Determining Specific Gravity of Gases"—Blake O. Cossey and Burton C. Sanders, Southern California Gas Co.

Paper No. 10

"Positive Displacement Meters"—Fred Winslow, Southern Counties Gas Co.

Paper No. 11

"Review of Southern California Meter Association Meter Course"—J. T. Cortelyou, Southern California Gas Co.

Awards

• **The United States Maritime Commission's "M" pennant with four gold stars was presented to Jenkins Bros., Bridgeport, Conn., on Sept. 2. Officiating at the simple ceremony were Bernard J. Lee, vice president in charge of manufacturing, and members of the Labor-Management Committee of the plant. It is the fourth time that the plant has been so honored since the initial award in March, 1943.**

• **The Philadelphia Gas Works Co. on August 24, received a National Security Award for "outstanding accomplishment in maintaining a superior standard of protection and security." Hudson W. Reed, president, accepted the pennant for the company, pledging continued alertness throughout the emergency.**

• **The Army and Navy "E" pennant has been awarded to the Rheem Manufacturing Co.'s No. 2 Chicago plant. This is the sixth Rheem plant to receive the "E" award and the second Rheem Chicago plant to get the pennant.**

THE PSEUDO-CRITICAL METHOD FOR EVALUATING

Deviation of Natural Gas from Boyle's Law

By R. V. DUNKLE

Pacific Gas and Electric Co., San Francisco

A STUDY of the psuedo-critical method of evaluating superexpansibility factors for natural gas has been undertaken in connection with tests made to extend the range of experimental deviation factors at Rio Vista gas field from 500 to 1000 psi. pressure. Simple linear equations have been developed for the calculation of the psuedo-critical constants from different properties of natural gas.

One set of these equations is thought to be especially useful, as they are based only on properties of the gas mixture which can be automatically and continuously measured and recorded, and are applicable over wide ranges of temperature and pressure to natural gases containing large amounts of nitrogen and/or carbon dioxide as diluents, as well as to those containing only hydrocarbons.

It is expected that this method will be very useful in the future due to the increased use of gas from dry gas fields containing large amounts of diluents, the employment of higher line pressures, and also, because it supplies a convenient procedure for calculating several other thermodynamic properties that are dependent upon temperature and pressure and have been correlated through the theory of corresponding states.

The use of these equations obviates the necessity of a complete fractional analysis of the gas, as they evaluate the psuedo-critical temperature and the psuedo-critical pressure of the natural gas in terms of specific gravity, heating value, and carbon dioxide content. The determination of the percent nitrogen is not necessary as its presence is accounted for both by an increase in specific gravity and decrease in heating value of the gas.

The equations for calculation of the psuedo-critical temperature and pressure from these variables are:

$$T_c = 128.5 + 90.1\,S + 0.1632\,h + 244\,C$$

and

$$P_c = 670.7 - 183.9\,S + 0.1028\,h + 683\,C$$

In using the psuedo-critical method of determining deviation factors, the above equations are used to calculate the psuedo-critical temperature and pressure of the gas. The reduced temperature is then calculated by dividing the absolute temperature by the psuedo-critical temperature, and the reduced gauge pressure is obtained by dividing the gauge pressure by the psuedo-critical pressure of the gas.

Gauge pressure is used instead of absolute pressure, as the deviation factor refers to the gas volume at one atmosphere pressure. The desired superexpansibility factor is then read from a graph or table of the superexpansibility factor as a function of reduced temperature and pressure. Fig. 1 is a graph of the superexpansibility factor for displacement meters, Y, and Table 1 gives the superexpansibility factor for orifice meters, F_{PV}, in terms of reduced temperature and pressure.

R. V. Dunkle

THE PSEUDO-CRITICAL method as presented by Mr. Dunkle provides a simple and accurate means of determining the deviation of superxpansibility factor in the large volume measurement of natural gas at high pressures. The principal advantages of this method are the ease of application to gases containing appreciable amounts of impurities, and the high accuracy obtained over wide ranges of pressure, temperature, and composition.

Mr. Dunkle graduated in chemistry from the University of California in 1938. He then spent two years of graduate work in Mechanical Engineering when he held a Standard Oil Fellowship. He has spent the last four years with the Pacific Gas and Electric Company as Assistant Engineer. During this time he has worked on transmission line gas heating, liquid and dust separators, friction factor in gas lines and heat transfer and pressure drop in gas generator checker brick.

The first draft of this paper was presented before the Conference on Production and Measurement, Technical Section, Pacific Coast Gas Association, Fresno, Calif., Feb. 16 and 17, 1944.

To illustrate the procedure in the application of this method to the determination of the deviation factor of natural gas, a sample from the T. McCormack well in the Rio Vista field, on which deviation tests (Fig. 2) were run, will be considered. This gas has a Btu of 1037, specific gravity of 0.575, and contained no carbon dioxide. The experimental deviation factor at 80° F. and 800 psi g. will be checked with the predicted value.

From the equations previously given, the psuedo-critical temperature and pressure are calculated as follows:

$$T_c = 128.5 + 90.1 \times .575 + .1632 \times 1037 + 244 \times O = 349.4$$

and

$$P_c = 670.7 - 183.9 \times .575 + .1028 \times 1037 + 683 \times O = 671.4$$

The reduced temperature is:

$$T_R = \frac{T}{T_c} = \frac{80 + 459.6}{349.4} = 1.544$$

and the reduced gauge pressure is:

$$P_R = \frac{p}{P_c} = \frac{800}{671.4} = 1.192$$

From Figures 1 at $P_R = 1.192$ and $T_R = 1.544$, $Y = 1.106$, whereas, by actual test at 80°F. and 800 psi g., $Y = 1.106$.

It is interesting to note the approximate error in Y introduced by an error in determining any of the variables. For example, with the above conditions for this particular gas, an error of 0.010 in the specific gravity would make an error of 0.0012 in the deviation factor, an error of 10 Btu. in the heating value would result in an error of 0.0022 in the deviation factor, and an error of 1% in the carbon dioxide would make an error of 0.0020 in the deviation factor. At lower pressures the errors introduced would be proportionately smaller. For the orifice meter superexpansibility factor, F_{pv}, the errors would be approximately half as large. These variables can ordinarily be determined with less error than that assumed in the above examples.

In Table 2, are listed the results of the deviation tests at 600 psi. and at

the various test temperatures. It can be seen that the results check quite closely, the worst errors occurring in the Aliso Canyon and Coalinga gases, which may have contained some condensate. As the error in the orifice meter superexpansibility factor is about one-half that in the deviation factor, Y, it can be seen that at 600 psi. the greatest error in F_{pv} is 0.0023 or approximately 0.2%. It is thought that this accuracy is acceptable for ordinary metering practice.

The combustion analysis and properties of the gas samples tested are given in Table 3. The experimental range covered in the tests was from 40° to 120° F., and from atmospheric to slightly over 1000 psi. g. pressure. The experimental results for the deviation factor, Y, are plotted in Fig. 3 against reduced temperature and pressure, showing the close correlation obtained by this method.

Naturally some of the difference between experimental and predicted factors can be ascribed to errors in deviation determinations, measurements of heating value, specific gravity determinations, and analyses for carbon dioxide content in the gas. However, some of the difference may be due to variations in the relative fractions of the higher hydrocarbons present, which the equations include as an average ratio; also part of the difference is doubtlessly due to deviations from the psuedo-critical relationship and the "theory of coresponding states."

A comparison of the California Natural Gasoline Association method of determining deviation factors with the psuedo-critical method shows the advantages of the latter. At pressures below 500 psi. for natural gas containing only hydrocarbons there is little to choose between the two methods. However, for pressures above 500 psi. or for gases containing appreciable amounts of diluents, the psuedo-critical method is superior. For gases containing nitrogen the CNGA. method holds fairly closely over the range covered in the tables, but requires an analysis of the gas for the per cent nitrogen. For gases containing carbon dioxide, the CNGA. tables are considerably in error.

Methods Compared

A comparison of the two methods for natural gases containing 8% and 24% carbon dioxide and having 0.700 and 0.800 specific gravity respectively will be considered. As these compositions are very similar to those on which tests were run, it is known that the psuedo-critical method is very accurate in these cases. The results are tabulated in Table 4.

It is evident that an error of approximately 1.3% would occur if the CNGA method were used in calculation of flow through an orifice meter for a natural gas mixture of 0.800 gravity containing 24% carbon dioxide at 485 psi and 60° F. At higher pressure the CNGA method is not applicable, while at lower pressures the error is less. The psuedo-critical method is especially advantageous for natural gas containing appreciable quantitites of diluents and at high pressures.

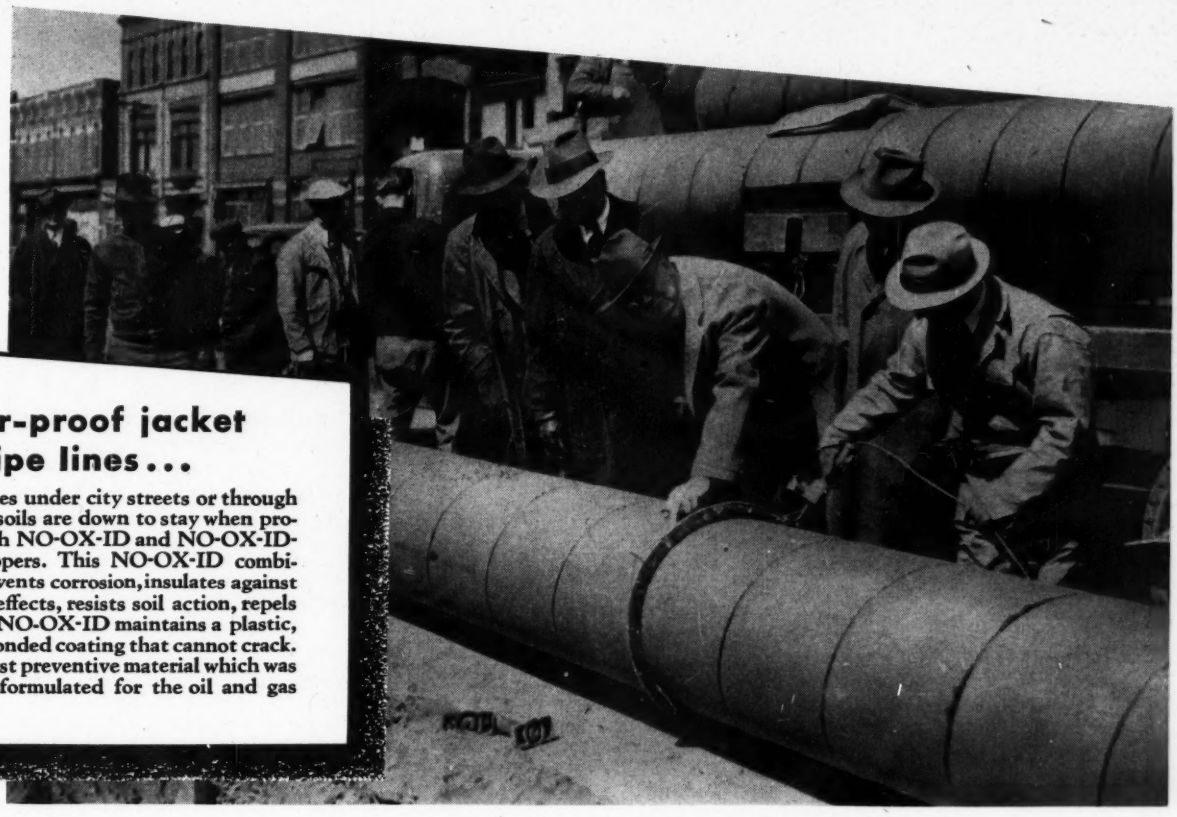
The psuedo-critical method is based on the theorem of corresponding states, which postulates that the deviation from the perfect gas law of all pure gases is nearly the same function of the reduced temperature and pressure, where the reduced temperature is defined as the absolute temperature divided by the critical temperature of the gas, and the reduced pressure is defined as the pressure divided by the critical pressure of the gas. In the case of gaseous mixtures the same relationship holds true with respect to the psuedo-critical temperature and pressure. The psuedo-critical temperature and pressure are calculated on a mol fraction ratio of the critical constants of the components of the gas mixture, and hence are called psuedo-critical, as they are not actually at the critical point of the mixture, although the volumetric behavior of the gas mixture is very nearly the same as that of a pure gas with the same critical constants.

One should not make the mistake of assuming that the psuedo-critical

TABLE 1

WIDE RANGE TABLE OF ORIFICE METER SUPEREXPANSIBILITY FACTORS, $F_{pv} = 1/Y$

Reduced Pressure P_r	REDUCED TEMPERATURE, T_r																			
	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.10
0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
.1	15	12	11	9	8	7	6	5	4	4	3	3	3	2	2	2	2	1	1	1
.2	30	25	22	19	16	14	12	11	9	8	7	6	6	5	5	4	4	3	2	2
.3	44	37	33	28	25	21	18	16	14	12	11	10	9	8	7	6	5	4	4	3
.4	59	50	44	38	33	29	25	22	19	17	15	13	12	10	9	8	7	6	5	4
.5	1.076	1.064	1.055	1.047	1.041	1.036	1.032	1.028	1.024	1.021	1.019	1.017	1.015	1.013	1.011	1.010	1.009	1.007	1.006	1.005
.6	95	79	66	57	50	44	38	33	29	26	22	20	18	15	14	12	10	9	8	6
.7	1.116	95	79	68	59	52	45	38	34	30	26	23	21	18	16	14	12	10	9	7
.8	41	1.113	92	78	68	59	51	45	39	34	30	27	23	21	18	16	14	12	10	7
.9	67	32	1.109	91	77	67	58	50	44	38	34	30	26	23	20	18	15	13	11	8
1.0	1.200	1.154	1.125	1.104	1.087	1.076	1.065	1.056	1.049	1.043	1.037	1.033	1.029	1.025	1.022	1.019	1.017	1.014	1.012	1.009
1.1	42	80	41	15	97	84	72	62	54	47	41	36	31	28	24	21	18	15	13	10
1.2	92	1.209	58	28	1.108	92	79	68	59	51	45	39	34	30	26	23	20	17	14	11
1.3	1.355	40	76	41	19	1.100	86	74	64	55	48	42	36	32	28	24	21	18	15	11
1.4	1.422	71	97	56	30	9	93	80	69	59	51	45	39	34	30	26	22	19	16	12
1.5	1.478	1.302	1.216	1.170	1.142	1.118	1.099	1.086	1.073	1.063	1.055	1.047	1.041	1.036	1.032	1.027	1.023	1.020	1.017	1.012
1.6	1.515	33	35	85	53	27	1.106	91	78	67	58	50	44	38	33	28	24	21	18	13
1.7	42	63	57	1.200	65	36	14	96	83	71	61	53	46	40	35	30	26	22	18	13
1.8	57	91	79	15	76	45	21	101	87	75	64	55	48	42	36	31	27	23	19	14
1.9	63	1.414	1.301	30	87	53	27	6	91	79	67	57	50	43	37	32	28	24	20	14
2.0	1.562	1.433	11321	1.244	1.197	1.161	1.134	1.111	1.095	1.082	1.070	1.060	1.052	1.045	1.039	1.033	1.029	1.025	1.020	1.014
2.1	58	45	39	57	1.207	69	40	16	99	85	72	62	54	46	40	34	30	25	21	15
2.2	51	51	53	69	16	76	45	21	1.103	88	75	64	55	48	41	35	31	26	21	15
2.3	40	53	62	81	25	83	51	25	6	91	78	66	57	49	43	36	31	27	22	15
2.4	28	50	66	90	32	89	55	30	10	94	80	68	59	51	44	37	32	27	22	15
2.5	1.513	1.445	1.367	1.297	1.239	1.194	1.160	1.134	1.113	1.097	1.083	1.070	1.060	1.052	1.045	1.038	1.032	1.028	1.023	1.015
2.6	1.498	38	67	1.301	43	1.200	64	37	15	99	84	72	62	53	45	39	33	28	23	16
2.7	83	28	67	3	47	4	68	40	18	1.101	86	74	63	54	46	39	33	28	23	16
2.8	67	18	64	3	50	7	71	43	21	3	88	75	64	55	46	40	34	29	24	16
2.9	51	8	58	2	51	10	74	45	23	5	89	77	65	56	47	40	34	29	24	16
3.0	1.435	1.397	1.352	1.299	1.252	1.212	1.176	1.148	1.125	1.106	1.091	1.078	1.066	1.056	1.048	1.041	1.034	1.029	1.024	1.016
3.2	06	76	37	92	52	13	79	49	27	8	93	79	67	57	48	41	35	29	24	15
3.4	1.378	53	21	83	46	11	79	49	28	9	93	80	68	58	48	41	35	29	23	15
3.6	52	32	4	72	39	6	77	49	28	10	94	80	68	58	48	41	35	29	23	14
3.8	27	11	1.287	59	30	1	74	48	27	9	94	80	67	58	48	41	34	28	23	13
4.0	1.302	1.289	1.269	1.244	1.219	1.194	1.170	1.146	1.126	1.108	1.093	1.079	1.067	1.057	1.048	1.040	1.034	1.028	1.022	1.012
4.5	1.246	38	26	10	1.191	73	53	35	17	1	86	73	63	53	44	37	30	24	18	9
5.0	1.199	1.194	1.185	1.174	1.162	1.148	34	1.119	1.105	1.090	1.077	1.065	1.055	1.045	1.037	1.030	1.024	1.018	1.013	1.004



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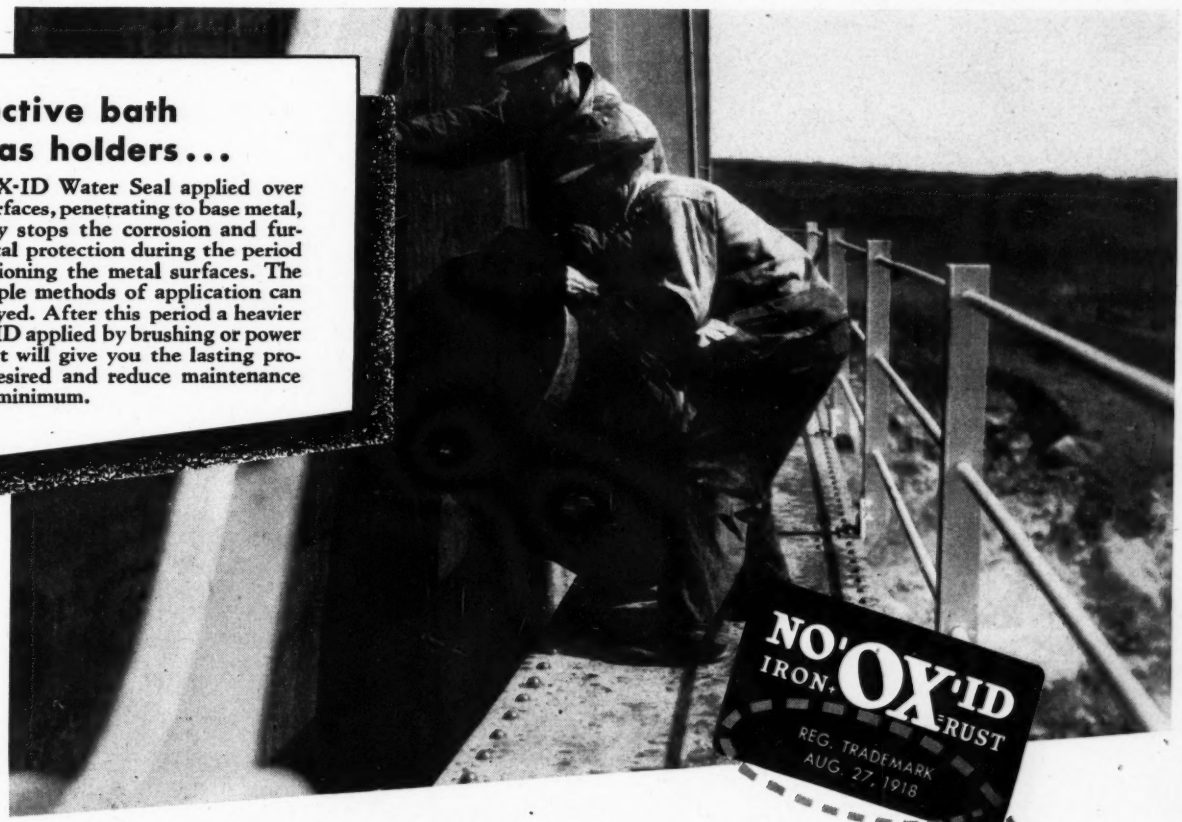

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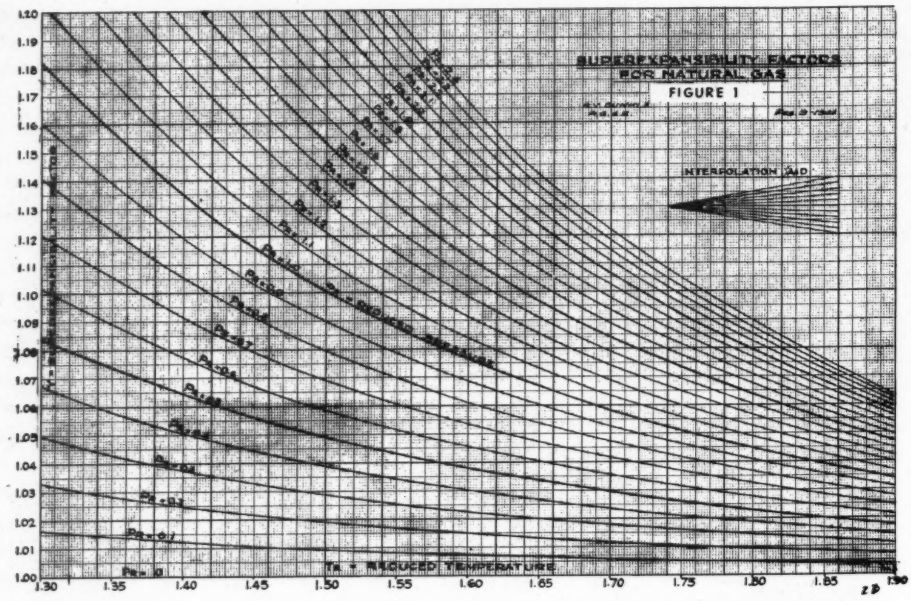
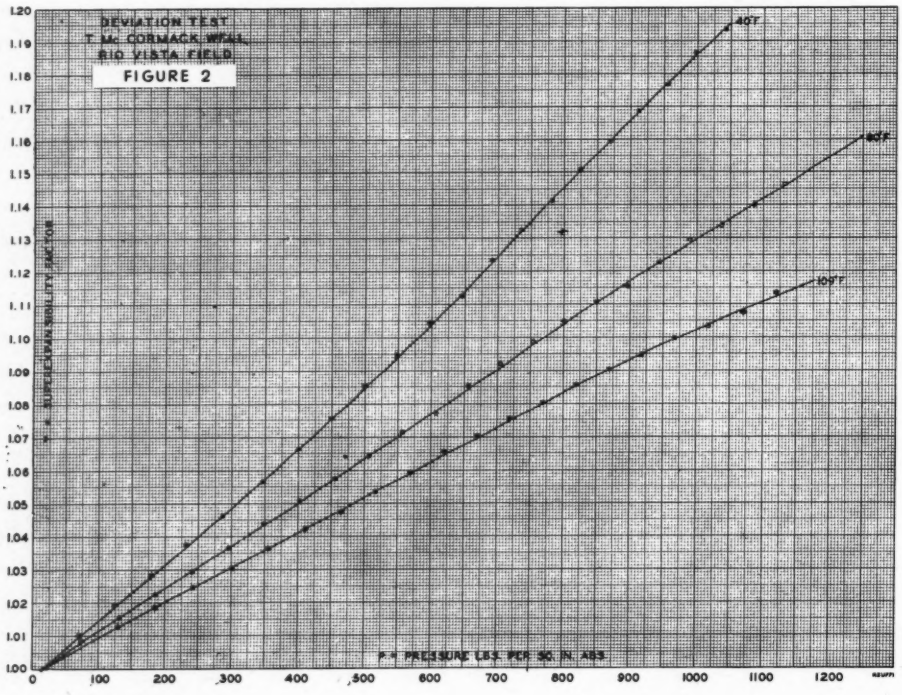




method of correlating superexpansibility factors is a rigorous law holding exactly for any temperature, pressure, and composition. On the contrary, this relationship cannot be expected to hold exactly, especially for such unlike gases as carbon dioxide, nitrogen, and the hydrocarbons; and if a high degree of accuracy is desired over a particular range of composition, temperature, and pressure, empirical corrections based upon experimental evidence are necessary.

It has been verified by many experimenters (3, 4) that the psuedo-critical method holds fairly closely for mixtures of hydrocarbons, and, in the case of natural gas when the per cent of diluents is small, that the psuedo-critical constants are nearly linear functions of the specific gravity of the gas. From this information it was logical to assume that the psuedo-critical constants of the hydrocarbon fraction of natural gas containing appreciable amounts of impurities would be the same linear functions of the specific gravity of the hydrocarbon fraction. Plotting available data (Fig. 4) on gas samples from Northern California fields, it was found that this relationship held true very closely, although on investigation of additional data it may be found necessary to make small changes in the slopes of these lines.

Concerning diluents in natural gas, only nitrogen and carbon dioxide are considered in this paper. Although hydrogen sulfide and oxygen are occasionally present in small amounts, it is thought that sufficient concentrations to noticeably affect the deviation factor ordinarily will not be tolerated. Other impurities than these are probably present only in negligible percentages. If any gas other than paraffin hydrocarbons, nitrogen, and carbon dioxide should be present in appreciable amounts, corrections to the psuedo-critical temperature and pressure can be easily made.

Since the main constituent of natural gas is methane, it is logical to base the deviation table upon data on the volumetric behavior of methane obtained by leading investigators in this field. Highly accurate experiments on the deviation of methane have been carried out by Sage and Lacey (9) and Kvalnes and Gaddy (10). Using this information a graph (Fig. 1) of the deviation factor, Y, has been plotted as a function of reduced temperature and pressure. In addition to this, a table (Table 1) of the orifice meter superexpansibility factor has been prepared covering a much wider range of conditions.

Results Checked

It was found that the deviation results on natural gas containing small amounts of diluents checked these tables very closely when the linear equations for T_{ex} and P_{ex} were used. However, gas mixtures containing relatively large amounts of nitrogen or carbon dioxide varied considerably from the predicted values when the true critical temperatures of nitrogen and carbon dioxide were employed in the calculations. By using the experimental results on natural gas mixtures, and the results of Sage and Lacey (9) on the deviation of mixtures of carbon dioxide and methane, it was possible to assign empirical values to the critical temperatures of nitrogen and carbon dioxide in order to make the plot of the deviation factors against the reduced temperature and pressure of the mixtures approach that of methane over the range of composition, reduced temperature, and reduced pressure under consideration.

The values which should be used in calculations with natural gas mixtures are 216° R instead of 227° F. for the critical temperature of nitrogen, and 510° R instead of 548° F. for the critical temperature of carbon dioxide. It was not necessary to make any corrections to the critical pressures of these gases, and the actual values are used in calculation of the psuedo-critical pressure.

In Fig. 5 are shown points calculated from experimental data on methane, mixtures of methane with carbon dioxide, and mixtures of natural gas with carbon dioxide; using the adjusted value of 510° R for the critical temperature of carbon dioxide. It must be remembered that the adjusted values for the critical temperatures of nitrogen and carbon dioxide have been determined as averages over a certain range of temperature and composition, and they are not recommended for mixtures containing over 35% of diluents. Considerable error occurs if these values are not used in the calculation of the psuedo-critical temperature. These values for the critical temperatures of carbon dioxide and nitrogen were used in developing the linear equations for the psuedo-critical temperature of natural gases given in this paper. A discussion of the equations developed for various conditions follows.

One Variable Sufficient

As long as natural gas contains only hydrocarbons, one variable in addition to the temperature and pressure has been found sufficient to determine the deviation factor with a reasonable degree of accuracy. The variable is generally taken to be the specific gravity, inasmuch as the specific gravity is necessary to compute the flow and can be easily determined in the field. The equations for the psuedo-critical temperature and pressure of gases containing only hydrocarbons are:

$$T_c = 152.5 + 345.4\ S$$

and

$$P_c = 685.8 - 23.1\ S$$

However, the use of the heating value of the gas would be just as reliable a means of obtaining the deviation factor. In this case the equations for the psuedo-critical constants are:

$$T_c = 120.0 + 0.2208\ h$$

and

$$P_c = 688.0 - 0.0148\ h$$

Although the equations for psuedo-critical temperature and pressure were developed especially for California natural gas, it is thought that they are generally applicable. Naturally one would expect some variation in gases from different regions, and in gases with various degrees of removal of the higher hydrocarbons in absorption plants.

Since carbon dioxide and nitrogen are almost invariably present in natural gas, further additions to the above formulas are necessary. Each added constituent increases by one

TABLE 2. COMPARISON OF EXPERIMENTAL AND CALCULATED VALUES OF THE DEVIATION FACTOR, Y, AT 600 PSI GUAGE

Gas Sample	*°F.*	*Tr*	*Pr*	*Experimental Y*	*Calculated Y*	*Difference*
Rio Vista—Oulton land....	40	1.452	.898	1.1018	1.1020	+.0002
Oulton land....	70	1.540		1.0803	1.0802	−.0001
Oulton land....	100	1.627		1.0632	1.0634	+.0002
Rio Vista—D. McCormack.	40	1.449	.902	1.1060	1.1032	−.0028
D. McCormack.	70	1.536		1.0838	1.0815	−.0023
D. McCormack.	100	1.623		1.0652	1.0646	−.0006
Rio Vista—Emigh No. 1...	40	1.423	.897	1.1098	1.1105	+.0007
Emigh No. 1...	70	1.509		1.0872	1.0871	−.0001
Emigh No. 1...	100	1.594		1.0670	1.0691	+.0021
Rio Vista—						
W&R Comm. No. 1.....	60	1.489	.896	1.0932	1.0920	−.0012
W&R Comm. No. 1.....	85	1.561		1.0766	1.0756	−.0010
W&R Comm. No. 1.....	120.2	1.662		1.0590	1.0576	−.0014
Rio Vista—T. McCormack.	40	1.430	.894	1.1070	1.1080	+.0010
T. McCormack.	80	1.544		1.0788	1.0790	+.0002
T. McCormack.	109	1.627		1.0638	1.0632	−.0006
Rio Vista—T. McCormack						
+9.0% CO_2.....	70	1.456	.848	1.0958	1.0948	−.0010
+9.0% CO_2.....	100	1.538		1.0760	1.0761	+.0001
+25.2% CO_2.....	70	1.366	.776	1.1160	1.1150	−.0010
Lodi—Comm. 15 No. 1....	40	1.615	.960	1.0683	1.0701	+.0018
Comm. 15 No. 1....	70	1.712		1.0539	1.0541	+.0002
Comm. 15 No. 1....	73	1.721		1.0524	1.0528	+.0004
Comm. 15 No. 1....	100	1.809		1.0429	1.0422	+.0002
Comm. 15 No. 1....	122	1.880		1.0352	1.0347	−.0005
Lodi+7.8% CO_2.....	73	1.639	.909	1.0616	1.0633	+.0017
+7.8% CO_2.....	100	1.720		1.0503	1.0511	+.0008
+20.8% CO_2.....	74	1.519	.838	1.0799	1.0790	−.0009
+20.8% CO_2.....	100	1.593		1.0656	1.0650	−.0006
Aliso Canyon.....	40	1.369	.895	1.1338	1.1298	−.0040
Aliso Canyon.....	70	1.451		1.1046	1.1018	−.0028
Aliso Canyon.....	100	1.533		1.0843	1.0821	−.0022
Aliso Canyon+7% CO_2...	70	1.412	.859	1.1130	1.1091	−.0039
Aliso Canyon+7% CO_2...	100	1.509		1.0864	1.0833	−.0031
Coalinga Field.....	75	1.405	.894	1.1219	1.1174	−.0045
Coalinga Field.....	105	1.484		1.0959	1.0934	−.0025

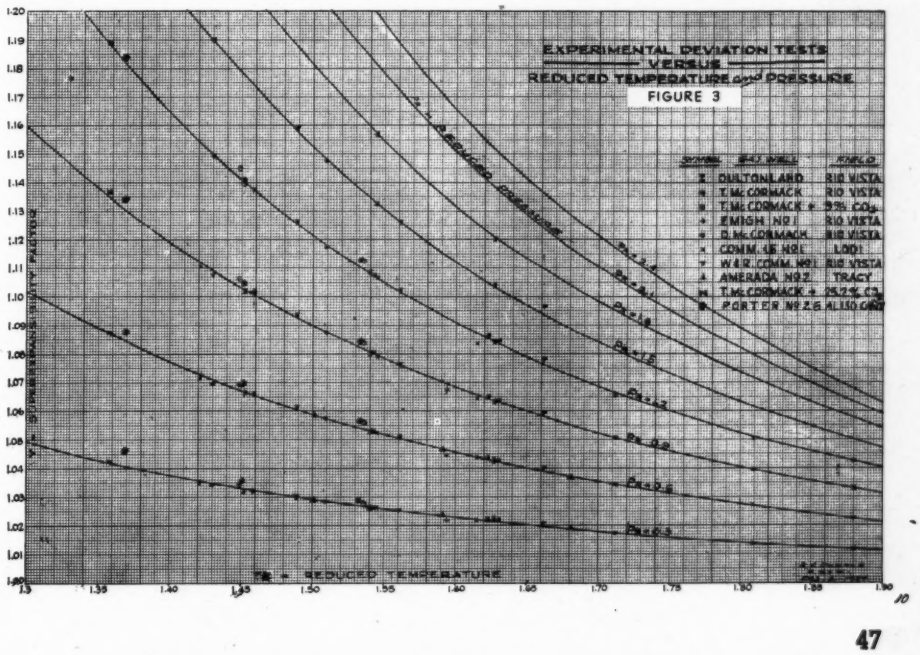
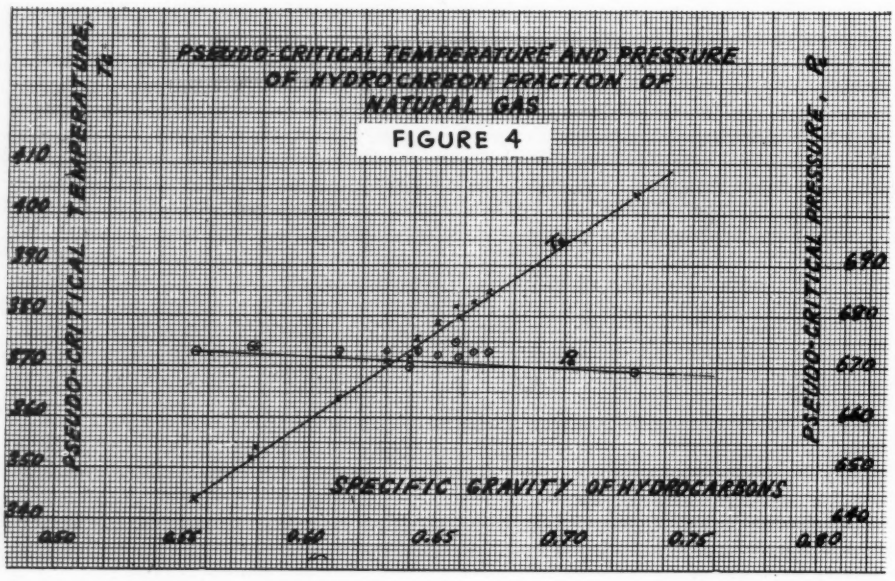


TABLE 3. SOURCE, COMBUSTION ANALYSIS, AND PROPERTIES OF GAS SAMPLES TESTED

Field	Well	CO_2	CH_4	C_2H_6	N_2	Calc. Btu.	Obs. Btu.	Calc. Sp. Gr.	Obs. Sp. Gr.	Calc. T_c	Calc. P_c
Rio Vista	Oultonland	....	95.6	2.7	1.7	1018	1005	0.575	0.573	344.0	668.5
Rio Vista	D. McCormack	....	92.0	4.0	4.0	1005	1000	0.590	0.590	344.8	664.9
Rio Vista	Emigh No. 1	0.2	92.4	5.9	1.5	1043	1033	0.591	0.594	351.0	669.0
Rio Vista	W. & R. Comm. No. 1	0.2	94.9	4.0	0.9	1034	1030	0.586	0.582	348.9	669.5
Rio Vista	T. McCormack	....	96.1	3.9	....	1045	1037	0.573	0.575	349.3	671.3
Rio Vista+CO_2	No. 1	9.0	87.4	3.6	....	944	....	0.654	0.654	363.1	707.9
Rio Vista+CO_2	No. 2	25.2	71.9	2.9	....	776	....	0.814	....	389.9	772.9
Lodi	Comm. 15 No. 1	....	73.5	....	26.5	746	743	0.665	0.663	309.4	625.1
Lodi+CO_2	No. 1	7.8	68.7	....	23.5	694	....	0.728	....	326.4	661.3
Tracy	Amerada No. 2	....	91.0	....	9.0	924	924	0.592	0.596	332.9	656.0
Aliso Canyon	Porter No. 26	....	87.4	12.6	....	1112	1106	0.616	0.619	364.8	670.5
Aliso Canyon+CO_2		7.0	81.3	11.7	....	1029	....	0.683	....	375.0	698.7
Lodi+CO_2	No. 2	20.8	59.0	....	20.2	599	....	0.840	....	351.2	715.8
Coalinga		0.2	79.6	20.2	....	1176	1168	0.661	0.654	380.5	671.3

TABLE 4

Spec. Gr.	% CO_2	Press. psi g.	Temp. °F.	Y CNGA	Y Ps. Cr.	F_{PV} CNGA	F_{PV} Ps. Cr.
0.700	8.0%	485	60° F.	1.1094	1.1025	1.0533	1.0500
0.800	24.0%	485	60° F.	1.1227	1.0962	1.0596	1.0470



the number of variables needed to determine the deviation factor. For example, in the territory served by the Pacific Gas and Electric Co., the carbon dioxide content of the gas is generally too small to have any appreciable effect on the deviation factor. However, in many of the gas fields, the nitrogen content is large. This means that to determine the deviation factor another variable in addition to the specific gravity is needed. This variable could be either the percent nitrogen or the Btu of the gas. Since the gas sales rate is based on the heating value of the gas, and recording calorimeters are located throughout the system, it is logical to make use of the heating value rather than analysis of the gas for its nitrogen content.

In case carbon dioxide is also present, it can easily be determined by chemical analysis at certain stated intervals, or a continuous record can be obtained by means of an automatic carbon dioxide analyzer. With a natural gas containing both nitrogen and carbon dioxide, three variables are required to determine the psuedo-critical temperature and pressure. These variables can either be Btu, specific gravity, and percent carbon dioxide; gravity, percent nitrogen, and percent carbon dioxide; or Btu, percent nitrogen, and percent carbon dioxide.

Of course the psuedo-critical constants can also be calculated from the complete fractional analysis of the gas, or by means of the combustion analysis if the proper constants are employed. As stated above, in the system of the Pacific Gas and Electric Co. the heating value of the gas is generally accurately known and recorded, and hence is a much better reference for determining superexpansibility factors than the percent nitrogen in the gas.

The equations developed for the psuedo-critical constants in the above cases are given below.

The equations based on the Btu' specific gravity, and carbon dioxide content are thought to be the most useful, and have already been discussed. For purposes of comparison they are repeated here:

$$T_c = 128.5 + 90.1\,S + 0.1632\,h + 244\,C$$

and

$$P_c = 670.7 - 183.9\,S + 0.1028\,h + 683\,C$$

If the specific gravity, nitrogen content, and carbon dioxide content are known the equations are:

$$T_c = 152.5 + 345.4\,S - 272.2\,N - 170.3\,C$$

and

$$P_c = 685.8 - 23.1\,S - 171.4\,N + 422.5\,C$$

When the Btu, nitrogen content, and carbon dioxide content are known the equations are:

$$T_c = 120.0 + 0.2208\,h + 96\,N + 390\,C$$

and

$$P_c = 688.0 - 0.0148\,h - 196\,N + 385\,C$$

When the complete fractional analysis of the gas is used for calculation of the psuedo-critical constants, the conventional method of calculating them on a mol fraction basis is used, with the exception that 216° R is used for the critical temperature of nitrogen instead of 227° R, and 510° R instead of 548° R is used for the critical temperature of carbon dioxide. Values of the critical constants of the common gases are given in Table 5, together with their specific gravity and heating value.

If the combustion analysis is used, the figures of 618.8 and 661.6 are assigned respectively to the critical temperature and pressure of ethane in order to correct for the higher hydrocarbons normally present in natural gas. This gives as the equations:

$$T_c = 344.0\ m + 518.8\ \epsilon + 216\ N + 510\ C$$

and

$$P_c = 673.0\ m + 661.6\ \epsilon + 492\ N + 1073\ C$$

Some discussion of specific applications of these equations to natural gas mixtures may help to clarify their practical utilization. For most metering practice the formulas can be used simply in setting up deviation tables for the specific cases, based on temperature and pressure, and eliminating the use of the formulas and reduced-properties in routine calculations.

For any particular well the composition of the gas tends to remain constant. There may be, however, considerable variation in the gas from different wells in the same field. For this reason each well in a gas field should have a test made of the specific gravity, heating value, and carbon dioxide content of the gas. The wells may then be grouped according to the psuedo-critical constants of the gas and superexpansibility tables made up for each group of wells covering the range of temperature and pressure in which the meters operate. In many cases the gas leaving the field will be of nearly constant properties, in which case one table based on temperature and pressure will suffice for the field. However, if much variation occurs in the gas leaving the field, additional tables for various ranges of specific gravity or heating value of the gas can be prepared.

Mixtures from Different Fields

In the case of gas mixtures from different fields, further complications may be involved, depending on the composition of the gases from the different fields. For a particular case consider a mixture of gas from Rio Vista and Lodi Fields. In this case the gas from each field is fairly consistent in composition, and hence it would be possible to base the superexpansibility factors on either the specific gravity or heating value of the mixture. However, due to the high nitrogen content of the Lodi gas, the deviation factor will decrease with increase in the specific gravity of the mixture; whereas for natural gas containing only hydrocarbons, the deviation factors increase rapidly with increase in specific gravity.

It is interesting to note what would happen if Kettleman Hills gas were mixed with Lodi gas. Both gases have approximately the same gravity, but the deviation of the Kettleman Hills gas is much greater than that of the Lodi gas. In this case it would be essential to base the superexpansibility factors on the heating value of the gas mixture.

If more complex mixtures of natural gas than the above examples are encountered, it may be preferable to go through the whole procedure of calculation of psuedo-critical constants, calculation of reduced temperature and pressure for the particular conditions, and then read the desired superexpansibility factor from a table based on reduced temperature and pressure. However, if it is desired to avoid numerical calculation, it is possible to set up a table of psuedo-critical temperature and pressure in terms of the specific gravity and heating value of the gas, with corrections for carbon dioxide if necessary. Using these values of psuedo-critical temperature and pressure, other tables serve to convert the observed temperature and pressure into reduced temperature and pressure. The superexpansibility factor for these conditions is then read from a table of the superexpansibility factor in terms of the reduced temperature and pressure. However, it is thought that conditions requiring such complete treatment are unusual, and that for most cases encountered in natural gas metering, it is possible to set up tables based on heating value or specific gravity for the particular gas mixture being metered so as to simplify the task of computing the flow.

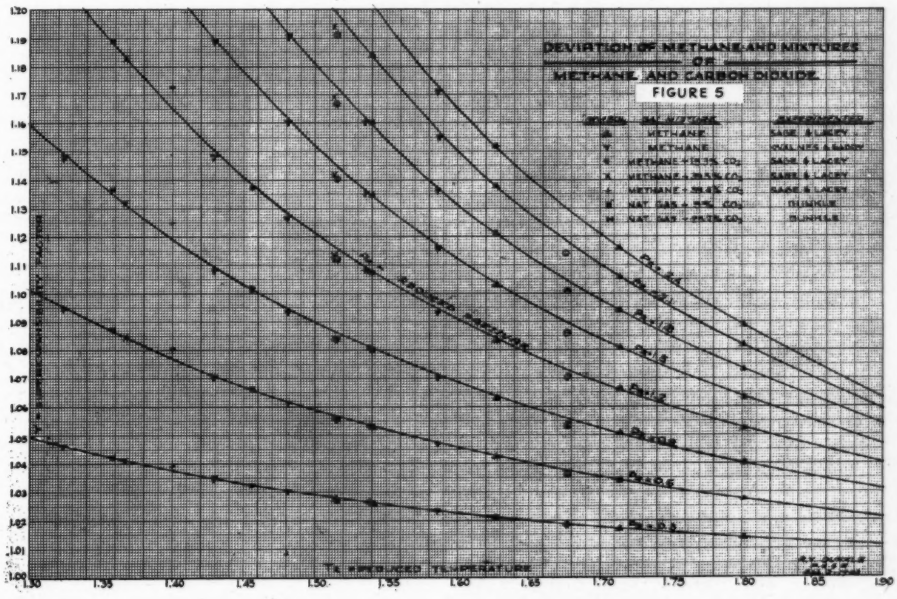


TABLE 5. CRITICAL CONSTANTS OF GASES

Gas	Critical Temperature	Critical Pressure	Perfect Gas Specific Gravity	Perfect Gas Heating Value
Methane	344	673	.5540	1013
Ethane	550	712	1.038	1775
Propane	665.6	617	1.522	2526
Iso-Butane	732	544	2.006	3268
n-Butane	766.5	529	2.006	3276
i-Pentane	830	484	2.491	4012
n-Pentane	847	485	2.491	4025
n-hexane	915	433	2.975	4773
n-heptane	976	405	3.46	5521
Hydrogen	61.6	188	0.0696	323.5
Oxygen	278	730	1.105	....
Nitrogen	227	492	0.967	....
Acetylene	556	907	0.911	1499
Ethylene	508.5	745	0.974	1614
Propylene	656	661	1.450	2336
Water	985	3200	0.622	....
Carbon Dioxide	548	1073	1.519	....
Carbon Monoxide	241	514	0.967	321.8
Hydrogen Sulfide	673	1307	1.176	673

It is thought that the methods given in this paper are very useful for the determination of superexpansibility factors for natural gas, particularly when large amounts of diluents are present. The accuracy of the superexpansibility factors predicted by this method is thought to be greater than the absolute accuracy obtainable in natural gas metering. At the present time there is no method available for exactly predicting superexpansibility factors and in any case where extreme accuracy is desired, recourse to an actual deviation test is necessary.

All deviation tests were run on the apparatus designed by P. E. Beckman of the Pacific Gas and Electric Co., of which descriptions have been previously published (1). The combustion gas analyses were performed by Frederick C. Jones, who also determined the specific gravities of the gas samples on the Edwards gas balance. De Witt Smith determined the heating value of the gas samples on a Thomas Recording Gas Calorimeter. All samples were run for periods of several hours so as to be sure equilibrium in the Calorimeter was reached. The heating value of the samples containing carbon dioxide was calculated, as it was thought that due to the solubility of the carbon dioxide that long periods of time would be required for saturation of the water. Much of the credit for this paper is due to Frank Wills and Mr. Beckman for their excellent advice and assistance on this problem.

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APPENDIX I

DERIVATION OF EQUATIONS

THIS derivation of expressions for the psuedo-critical temperature and pressure consists simply of setting up linear equations based on experimental evidence or on the laws of gas mixtures, and solving them simultaneously to eliminate the undesirable variables. Only the one case for calculation of the psuedo-critical temperature and pressure from the specific gravity, heating value, and carbon dioxide content is given here as all the other derivations are similar.

The relationship between the heating value and specific gravity of the hydrocarbon fraction of natural gas is:

$$S_x = 0.0006394\ h_x - 0.0940 \tag{1}$$

The equation for the psuedo-critical temperature of the hydrocarbon fraction of natural gas in terms of its specific gravity is from Fig. 4:

$$T_{cx} = 152.5 + 345.4\ S_x \tag{2}$$

The equation for the psuedo-critical pressure from Fig. 4 is:

$$P_{cx} = 685.8 - 23.1\ S_x \tag{3}$$

Derivation of Equation for Pseudo-Critical Temperature.

From the definition of the psuedo-critical temperature the following equation can be written for a natural gas, consisting of a hydrocarbon fraction, nitrogen, and carbon dioxide:

$$T_c = X\ T_{cx} + N\ T_{cn} + C\ T_{cc} \tag{4}$$

From the laws of gas mixtures the following equations are obtained:

$$N + C + X = 1 \tag{5}$$

$$N\ S_n + C\ S_c + X\ S_x = S \tag{6}$$

$$X\ h_x = h \tag{7}$$

To eliminate "N" multiply equation (5) by S_n and subtract the product from equation (6) giving:

$$Sn - S = C\ (Sn - S_c) + X\ (Sn - S_x) \tag{8}$$

Substitute equation (7) into (1) giving:

$$S_x = 0.0006394\frac{h}{X} - 0.0940 \tag{9}$$

From equation (8) and (9) on elimination of S_x is obtained:

$$Sn - S = C\ (Sn - S_c) + XS_n - .0006394\ h + 0.0940\ X \tag{10}$$

Solving for X from (10) gives:

$$X = \frac{0.0006394\ h + Sn - S + C\ (S_c - Sn)}{Sn + 0.0940} \tag{11}$$

Now return to equation (2) and multiply both sides by X giving:

$$X\ T_{cx} = 152.5\ X + 345.4\ X\ S_x \tag{12}$$

and upon substitution for S_x from (9):

$$X\ T_{cx} = 152.5\ X + 345.4\ (.0006394\ h - 0.0940\ X) \tag{13}$$

or

$$X\ T_{cx} = 120.0\ X + 0.2208\ h \tag{14}$$

Substitute into (4) from (14) for $X\ T_{cx}$ and from (5) for N giving:

$$T_c = 120.0\ X + 0.2208\ h + (1 - C - X)\ T_{cn} + C\ T_{cc}$$

or

$$T_c = (120.0 - T_{cn})\ X + 0.2208\ h + T_{cn} + C\ (T_{cc} - T_{cn}) \tag{15}$$

Substituting for X in equation (15) from (11) gives:

$$T_c = \left(\frac{.0006394\ h + S_n - S + C\ (S_c - S_n)}{Sn + 0.1012}\right)(120.0 - T_{cn}) + 0.2208\ h + T_{cn} + C\ (T_{cc} - T_{cn}) \tag{16}$$

The numerical values used for the various constants in this work are: $T_{cc} = 510$, $T_{cn} = 216$, $P_{cc} = 1073$, $P_{cn} = 492$, $S_c = 1.528$, and $S_n = 0.972$. Substituting numerical values into equation (16) and simplifying gives the final equation for the psuedo-critical temperature of natural gas in terms of its specific gravity, heating value, and carbon dioxide content.

$$T_c = 128.5 + 90.1\ S + .1632\ h + 244\ C \tag{17}$$

(Continued on Page 55)

(Continued from Page 52)

Derivation of Equation for Pseudo-Critical Pressure.

From the definition of the psuedo-critical pressure the following equation can be written:

$$P_c = X\,P_{cx} + N\,P_{cn} + C\,P_{cc} \qquad (18)$$

From equation (3) and (9), eliminating S_x:

$$X\,P_{cx} = 688.0\,X - 0.0148\,h \qquad (19)$$

From equations (18) on substitution from (19), and (5) for $X\,P_{cx}$ and N is obtained:

$$P_c = (688.0 - P_{cn})\,X - 0.0148\,h + P_{cn} + C\,(P_{cc} - P_{cn}) \qquad (20)$$

And substitution in (19) for X from equation (12) gives:

$$P_c = \left(\frac{.0006394\,h + S_n - S + C\,(S_c - S_n)}{S_n + 0.0940 - 0.148\,h + P_{cn} + C\,(P_{cc} - P_{cn})}\right)(688.0 - P_{cn}) \qquad (21)$$

which gives, upon substitution of numerical values for the constants, the following equation for the psuedo-critical pressure of natural gas in terms of its specific gravity, heating value, and carbon dioxide content.

$$P_c = 670.7 - 183.9\,S + 0.1028\,h + 683\,C \qquad (22)$$

NOMENCLATURE

C = Volume fraction of carbon dioxide in gas $\left(\frac{\text{Percent } CO_2}{100}\right)$

e = Volume fraction of ethane $\left(\frac{\text{Percent ethane}}{100}\right)$

$F_{pv} = \sqrt{Y}$ = Super expansibility factor for orifice meters.

h = Heating value of gas (Btu. per cu. ft.)

h_x = Heating value of hydrocarbon fraction of gas (Btu. per cu. ft.)

N = Volume fraction of nitrogen in gas $\left(\frac{\text{Percent } N_2}{100}\right)$

m = Volume fraction of methane $\left(\frac{\text{Percent methane}}{100}\right)$

p = Gauge pressure (Lbs. per sq. in.)

P = Absolute pressure (Lbs. per sq. in.)

P_r = Reduced pressure Dimensionless

P_c = Psuedo-critical Temperature of gas (Lbs. per sq. in.)

P_{cx} = Critical pressure of hydrocarbon fraction (Lbs. per sq. in.)

P_{cc} = Critical pressure of carbon dioxide (Lbs. per sq. in.)

P_{cn} = Critical pressure of nitrogen (Lbs. per sq. in.)

S = Specific gravity of natural gas (Air = 1)

S_x = Specific gravity of hydrocarbon fraction (Air = 1)

S_c = Specific gravity of carbon dioxide (Air = 1)

S_n = Specific gravity of nitrogen (Air = 1)

T = Absolute Temperature (°R)

T_c = Psuedo-critical temperature of natural gas (°R)

$T_r = \frac{T}{T_c}$ = Reduced temperature Dimensionless

T_{cx} = Critical temperature of hydrocarbon fraction (°R)

T_{cc} = Critical temperature of carbon dioxide (°R)

T_{cn} = Critical temperature of nitrogen (°R)

X = Volume fraction of hydrocarbons in gas $\left(\frac{\text{Percent hydrocarbons}}{100}\right)$

$Y = \frac{PV}{P_cV_c}$ = Deviation factor from Boyle's Law or Superexpansibility factor for displacement meters.

High Cetane Diesel Fuel Obtained From Natural Gas

A high cetane diesel fuel, which may have revolutionary effects, is now undergoing extensive tests at one of the Bureau of Ships laboratories to determine its value for combat service both for present and possibly new design Navy engines. The immediate use of the new fuel lies in improving the quality of low cetane fuels and augmenting the present supply for the many diesel ships in the fleet. Its future possibilities appear very promising since it may make 100 cetane fuel practicable where 50 cetane is now the average for high-quality diesel fuel. It is produced from a fluid obtained by synthesizing natural gas.

The quantity of fuel which can be obtained from this source represents only a small fraction of the total fuel production now obtained from natural petroleum. Used as a blend, however, it can have important effects in improving the quality of the present low cetane petroleum fuel and increasing the over-all volume.

The process by which the fuel is produced requires a minimum of critical alloy steel and will employ catalytic technology developed by the synthetic rubber and aviation gasoline programs. The work, being carried on under the direction of the Research and Standards Branch of the Bureau of Ships, indicates that this process will make a considerable quantity of a valuable war fuel available to aid in relieving the critical shortage of petroleum products.

New Synthetic Toluene Process Patented

Toluene, basic material for TNT (which in chemical longhand is trinitro-toluene) can be made synthetically from two cheap, abundant substances found in oil and natural gas, by a new process on which U. S. patent 2,352,199 has just been issued to Prof. Vladimir N. Ipatieff and George S. Monroe, both of Chicago.

The substances are benzene, one of the common light fractions of petroleum, and methane, simplest of the hydrocarbon gases, which is one of the chief constituents of most natural gases and is also produced in quantity in certain petroleum-cracking processes.

In the Ipatieff-Monroe synthesis, benzene and methane are subjected to high pressure between 50 and 450 atmospheres at a temperature of from 350 to 750° C., in the presence of a catalyst. With the toluene, diphenyl is also synthesized; this co-product has a number of industrial uses.

Oklahoma Natural To Buy Additional Properties

The Oklahoma Natural Gas Co., Tulsa, Okla., has signed a contract to purchase gas production, pipelines and distribution systems of the Oklahoma Utilities Co., of Bristow, Okla., at an estimated price of $280,000, subject to approval from SEC and other regulatory agencies. Properties mentioned in the contract are located in five northeastern Oklahoma Counties and include local distributing plants at Bristow, Drumright and Mounds, Okla.

A New Portable Gas Gravitometer

By W. A. McGLASHEN

Southern California Gas Co., Los Angeles*

THE purpose of this paper is to explain the operating principle, design and mechanics of operation of a new, portable, single whistle type, gas gravitometer. It was developed to supply a need for a low cost, self-contained, easily portable instrument that can be operated by a simple procedure in the field to determine the accurate specific gravity of a gas.

This gravitometer (see Figs. 1 and 2) makes use of the relation between the density of a gas and the effective length of a single vibrating column of that gas to reproduce a given frequency of sound-wave. It is believed that it represents the first successful attempt to use this principle in the determination of the specific gravity of gases.

Operating Principle and Procedure: The frequency or pitch of the sound wave produced by a whistle of fixed length depends on the density, temperature, pressure and ratio of specific heats $\left(\frac{C_p}{C_v}\right)$ of the gas within the whistle. It follows that any given frequency of sound-wave can be reproduced by changing the whistle length an amount depending on the specific gravity, temperature, pressure and ratio of specific heats of the gas. It also follows that if the temperature, pressure and ratio of specific heats of a particular gas and the effective length of a whistle to produce a given frequency of sound-wave by use of that gas are known, an equation can be written which gives the specific gravity of the gas in terms of those values. A derivation of a general and an operating equation is given later in this paper.

In actual practice, the operating equation is used to construct operating curve-sheets similar to Fig. 3, for the determination of the specific gravity of gases from measured whistle lengths and observed gas temperatures when the whistle is sounded at a given frequency of sound-wave.

This gravitometer (see Figs. 1 and 2) makes use of the fact that when the natural frequency of a properly constructed resonator is equal to that of a nearby source of sound—in this case an adjustable closed-end whistle—a large amplitude of vibration is produced in the resonator, which vibration can be used to generate an electric current which in turn can by proper amplification, be made to actuate an indicating ammeter during the time that the frequency of sound-wave produced by the whistle and that of the resonator is identical.

This instrument consists of a simple mechanical means for sounding an adjustable, closed-end whistle at a given pressure and for varying the effective length of the whistle by use of a piston operated by a micrometer which indicates the effective length of the whistle when a pre-determined frequency of sound wave is being reproduced as indicated by a resonance or single frequency indicator.

An actual test with this instrument requires about one minute and consists of sounding the whistle with the test gas at a given pressure and adjusting its length to that necessary to reproduce the pre-determined frequency of sound-wave. The observed gas temperature and the effective length of the whistle, as indicated by the micrometer reading, are then used to determine the specific gravity of the gas from a curve-sheet constructed for the type of gas being tested.

Derivation of General Equation: The derivation of a simplified general equation for expressing the specific gravity of a gas in terms of its temperature, ratio of specific heats and the effective length of a closed-end whistle sounded at a given pressure to reproduce a given frequency of sound-wave is as follows:

Nomenclature:

V=Velocity of sound, ft. per sec.
N=Rate of vibration, oscillations per sec.
W=Wave length of sound, ft.
d_a=Density of air; 0.07654 pounds per cu. ft. @ 60°F., 30 in. Hg.
S=Specific gravity of gas (Air=1).
T=Temperature of gas at whistle, °F.
K=Ratio of specific heats of gas, $\left(\frac{C_p}{C_v}\right)$ at (T).
T_c=Correction for gas temperature other than 60°F.
P=Gas pressure, psi., absolute.
g=Acceleration of gravity = 32.17 ft. per sec. per sec.
l=Effective length of closed-end whistle, in.

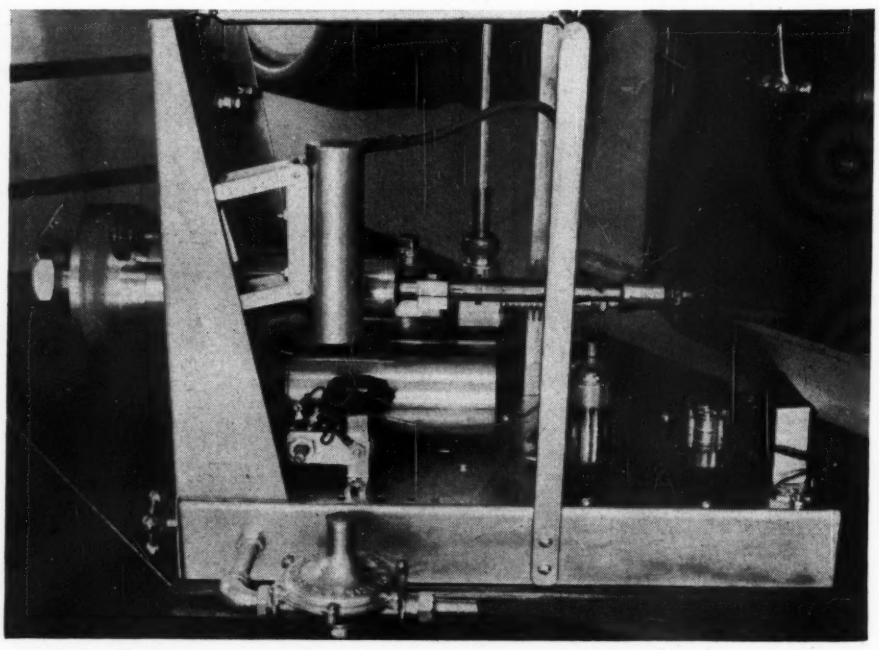


FIG. 1. Right side view of new portable gas gravitometer, single whistle type.

*This new single whistle type portable gas gravitometer was developed by D. C. Hill and W. A. McGlashen, both of Southern California Gas Co.

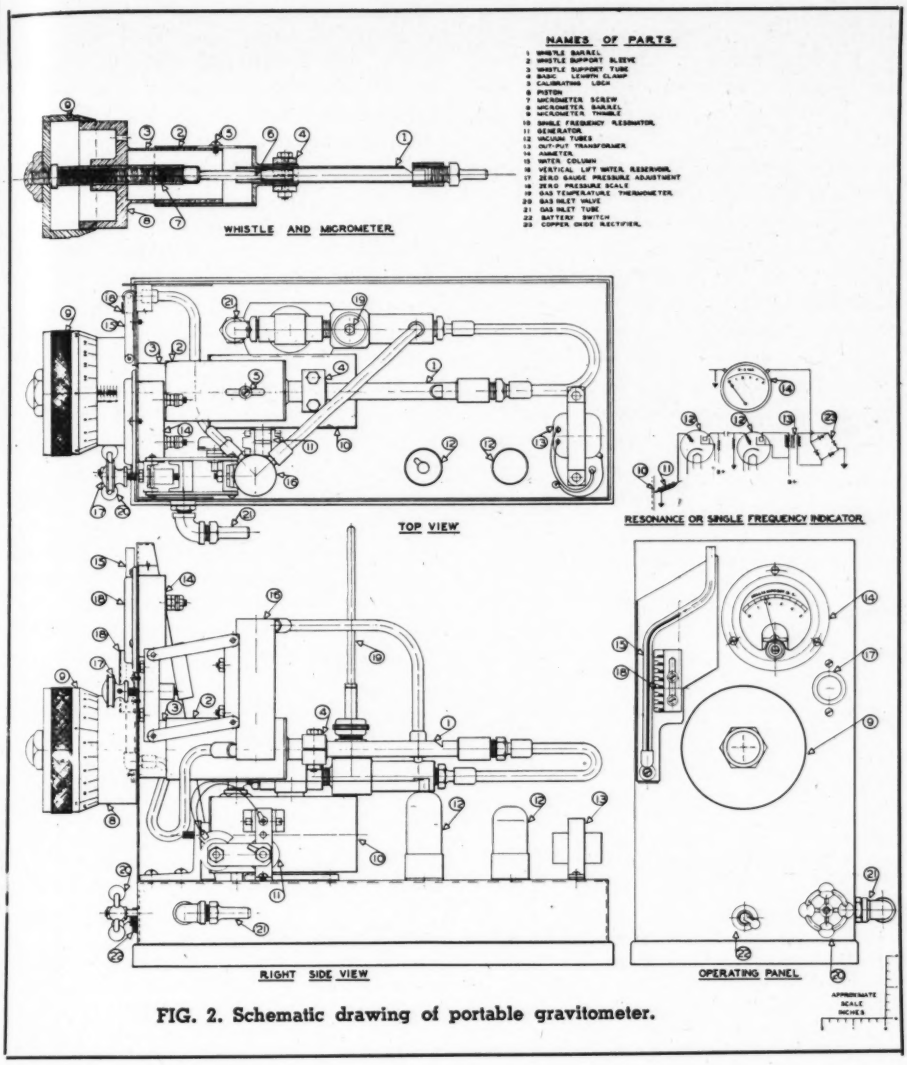


FIG. 2. Schematic drawing of portable gravitometer.

The velocity of sound in a gaseous medium is

$$V = N \times W \qquad (1)$$

or

$$V = \sqrt{\frac{144 \times g \times P \times K \times T_a}{d_a \times S}} \qquad (2)$$

For closed-end whistles the fundamental wave length in feet is

$$W = \frac{4l}{12}$$

and from Equation (1)

$$V = \frac{4Nl}{12}$$

and from Equation (2)

$$\frac{4Nl}{12} = \sqrt{\frac{144 \times g \times P \times K \times T_a}{d_a \times S}}$$

from which

$$S = \left(\frac{(144)^2 \times g \times P}{d_a \times (4N)^2}\right) \times \left(\frac{K \times T_a}{(l)^2}\right) \qquad (4)$$

If the effective length of the whistle (l) is to be adjusted with changes in the specific gravity of the gas (S) to reproduce a given frequency (N) when the whistle is sounded at given gas pressure (p) we can substitute a constant (a) for the expression

$$\left(\frac{(144)^2 \times g \times P}{d_a \times (4N)^2}\right) \qquad (4E)$$

in Equation (4) to form the Simplified General Equation

$$S = \frac{a \times K \times (460+T)}{520(l)^2} \qquad (5)$$

in which

S=Specific gravity of the gas (Air=1).

a=A constant depending on gas pressure, whistle construction and desired constant frequency.

T=Temperature of the gas at the whistle, °F.

K=Ratio of specific heats $\left(\frac{C_p}{C_v}\right)$ of the gas at T.

l=Effective length of the whistle in inches.

Since the ratio of specific heats $\left(\frac{C_p}{C_v}\right)$ of the gas appears as a factor in the operating equation, and since this factor is different for each type of gas, each instrument would be supplied with at least one standard solution curve-sheet for each of the following important fuel gases: Natural; Oil; Carburetted Water; Coal and Coke-oven; Producer (coal and coke); and Blast Furnace. See Fig. 3. The user would also be furnished with sufficient information to enable him to construct a special solution curve-sheet for each unusual type of gas or mixture of gases that he may have reason to test.

Mechanics of Operation and Construction: The accurate determination of gas specific gravity by the use of one adjustable whistle sounded with the gas at any temperature and a given pressure to reproduce a predetermined frequency of sound-wave or pitch requires the use of an exact mechanical means for determining, by visual observation, when the predetermined frequency of sound-wave has been reproduced; for determining the effective length of the whistle to about .002 in.; a mechanical means for gas pressure adjustment, reproduction and control to less than 1/16 in. of water, as well as a thermometer for indicating within one degree, the temperature of the gas passing through the whistle, and a means by which the measured effective length of the whistle and the observed gas temperature can be used to determine the specific gravity of the gas being tested.

Fig. 2 is a drawing showing the mechanical and electrical details of one model of the new portable, single whistle type gas gravitometer designed to fulfill the requirements for such an instrument.

Whistle Construction: The whistle (1) used in the instrument described here is the closed-end type made of ¼ in. standard brass pipe and fitted with a piston (6) for changing its effective length. The whistle barrel is supported by a brass sleeve (2) to which it is attached by the clamp (4). This whistle supporting sleeve (2) is in turn supported by passing it over an open tube (3) the other end of which is securely fastened to the back of the operating panel and to which the whistle supporting sleeve (2) can be clamped in any desired position. This mechanical arrangement is for the purpose of adjusting the basic length of the whistle and locking it in the correct position as determined by observations made during the preliminary calibration of the instrument.

Micrometer for Piston Adjustment: The operating adjustment of the length of the whistle is made by use of the piston (6) which is attached to the

end of the screw of a barrel type .001 in. micrometer. By turning the micrometer thimble (9) the piston can be moved toward or away from the whistle mouth and its position read to the nearest .001 in. on the micrometer. The barrel and thimble of the micrometer are mounted on the face of the operating panel.

Single Frequency Resonator and Electrical Indicator: The resonator (10) is constructed of seamless brass tubing having the following dimensions: length 4-27/32 in.; outside diameter 2-½ in.; wall thickness 3/64 in. This resonator is supported at one end by a bracket in such a manner that it is parallel to and directly beneath the whistle barrel. The resonator is attached to the bracket by use of a rubber insulator which prevents metal to metal contact between the bracket and the resonator.

In contact with the side of the resonator is one end of a small steel wire, the other end of which is attached to a metal plate which is free to move in a magnetic field; this assembly has been termed the generator (11). Thus any vibration of the resonator (10) causes the metal plate to move in a magnetic field to generate an alternating electric current which after passing through amplifier tubes (12) a transformer (13) and rectifier (23) actuates a sensitive ammeter (14) which is mounted on the face of the operating panel.

When the effective length of the whistle is adjusted so that the frequency of the sound-wave produced by the whistle is equal to the natural frequency of the resonator a large amplitude of vibration is produced in the resonator and the ammeter will indicate maximum current flow, and any further change—.001 or .002 in. —in the effective length of the whistle will result in a noticeable decrease in the amount of electrical energy produced. No current will be generated until the length of the whistle has been adjusted to within a few thousandths of an inch of the exact effective length necessary to produce the correct frequency of sound wave, at which point the first indication of current flow will be observed and, as the whistle length is brought closer to the correct value, the amount of current generated will increase to reach a maximum only when the whistle is in correct adjustment.

It is an important fact that the accuracy of determinations does not depend on the reproduction of a predetermined amount of electrical energy but only on whether any further change in the effective length of the whistle causes a decrease in the maximum amount of electrical energy that can be produced under the particular conditions prevailing during the time of test. This is important because, under these conditions, ordinary changes that may occur in the efficiency of the electrical system will have no effect on the accuracy of results, provided that the amount of electrical energy produced is such as to actuate the ammeter through a range sufficient to determine when the maximum current is being generated.

Gas Pressure Control and Adjustment: The means for controlling the gas pressure at a pre-determined value consists of the following equipment:

A single glass tube water column (15), the upper section of which extends across the face of the panel at an angle of approximately 30 degrees above the horizontal. At the center of the sloping section of the water column the tube is marked. This is the point to which the water meniscus is adjusted when tests are being conducted.

Water is supplied and pressure is transmitted to the water column through a rubber tube connection between the lower end of the water column and the bottom of a water reservoir (16) mounted on the back of the operating panel. This reservoir is equipped with a vertical-lift mechanism controlled from the front of the panel. A rubber tube connection between the gas inlet (21) to the whistle and the upper end of the water reservoir (16) transmits the gas pressure to the water in the reservoir. Thus any pressure change in the system is indicated by a change in height of water in the gauge glass (15) on

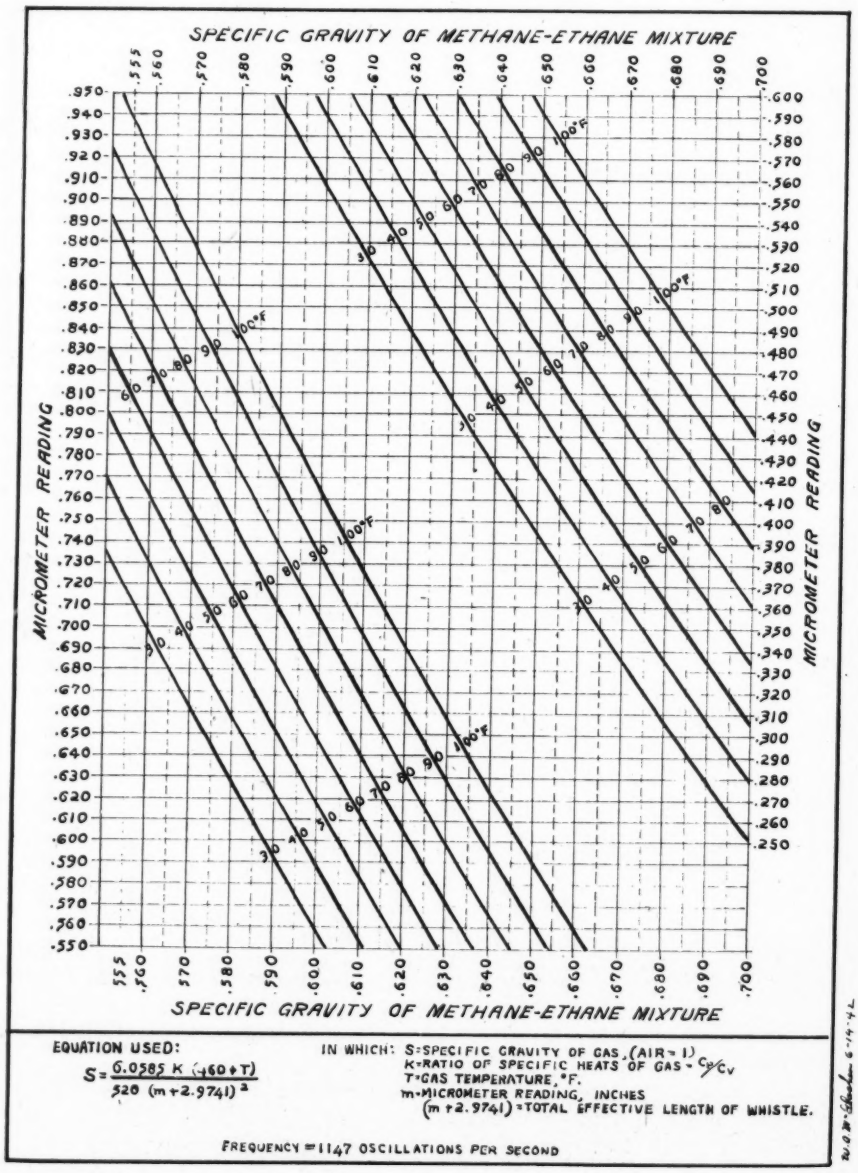

SPECIFIC GRAVITY OF METHANE-ETHANE MIXTURE
MICROMETER READING
SPECIFIC GRAVITY OF METHANE-ETHANE MIXTURE
EQUATION USED:
S = 0.0585 K (460+T) / 520 (m+2.9741)²
IN WHICH: S=SPECIFIC GRAVITY OF GAS, (AIR=1)
K=RATIO OF SPECIFIC HEATS OF GAS = Cp/Cv
T=GAS TEMPERATURE, °F.
m=MICROMETER READING, INCHES
(m+2.9741)=TOTAL EFFECTIVE LENGTH OF WHISTLE.
FREQUENCY = 1147 OSCILLATIONS PER SECOND

FIG. 3.

"Never mind little bride, some day you'll have a range that really cooks

...and it's going to be a brand new *Magic Chef*"

THE DAY IS COMING—and let's hope it will be soon—when you and your husband can settle down in a "Happiness House" of your very own!

Then you can stop worrying over the uncertain performance of that old-fashioned stove. Because, of course, he's going to insist on getting you a range that *really* cooks—a sparklingly new Magic Chef. It will be *beautiful* as well as convenient and practical. And so easy to use, with gas, the *ideal* fuel!

Until our war job is done, we can't build your new Magic Chef for you. But it will be ready just as soon as possible after victory. And it will be worth waiting for!

★ ★ ★

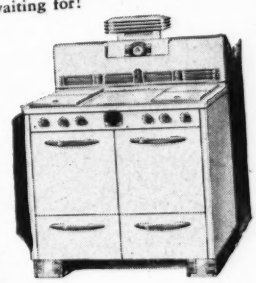
Do you live beyond the gas mains? If so, we assure you that fine, new Magic Chef ranges will be available after the war for "Pyrofax" Gas in eastern and central states and for other L. P. (bottled and tank) gases elsewhere. ★ ★ ★

One of American Stove Company's plants is building a gas range in the model permitted by W. P. B. If your immediate need for a range is urgent, ask your dealer or gas company how you can get one.

★ ★ ★

(CP) This "CP" seal on your post-war Magic Chef will assure you of "Certified Performance" in your cooking. Look for it.

AMERICAN STOVE COMPANY
Cleveland, Ohio



You can plan on owning a Magic Chef like this after the war

Magic Chef

THE RED WHEEL GAS RANGE WITH THE LIFETIME BURNER GUARANTEE

Copr. 1944 American Stove Co.

THE SATURDAY EVENING POST · GOOD HOUSEKEEPING
WOMAN'S HOME COMPANION · ARCHITECTURAL FORUM
PARENT'S MAGAZINE · BETTER HOMES & GARDENS

is doing these things

1 Maintaining outstanding public preference for Magic Chef Gas Ranges.

2 Presenting the Magic Chef story to your best postwar prospects against a background of timely, human interest situations in present day American homes.

3 Informing your prospects that Magic Chef gas ranges will be available for regular city gas service and L.P. bottled or tank gases.

4 Creating the desire in your prospects to have a Magic Chef Gas Range.

The advertisement shown at the left appears in the October 14th issue of THE SATURDAY EVENING POST and in other leading national magazines.

For franchise information on Magic Chef Gas Ranges, write your nearest American Stove Company office.

AMERICAN STOVE COMPANY
4901 Perkins Avenue · Cleveland, Ohio
NEW YORK · PHILADELPHIA · CLEVELAND · CHICAGO
ST. LOUIS · ATLANTA · LOS ANGELES

Magic Chef

RED WHEEL GAS RANGES
AND HEAVY DUTY GAS COOKING EQUIPMENT

The Symbol of "Certified Performance" (CP)

ARMY (E) NAVY

Awarded to Quick Meal Stove Co. Division of American Stove Co.

the front of the panel. The adjustable, vertical-lift reservoir is for the purpose of adjusting the water to the zero pressure position in the gauge glass during calibration and for the reproduction of an exact zero pressure setting during the subsequent operation of the instrument.

During the operation of the instrument a needle valve (20) is closed in the gas line before the whistle and the vertical-lift reservoir (16) is adjusted to bring the water in the gauge glass to correct zero pressure position, after which the correct pressure is maintained by adjusting the needle-valve until the water meniscus coincides with the upper or operating mark on the gauge glass.

The error resulting from the use of incorrect gas pressure is about 1% of the specific gravity of the gas for each ¼ in. of water pressure variation from the standard operating gauge pressure for the surrounding temperature. The error is positive for pressure less than, and negative for pressures greater than, the standard operating gauge pressure.

As explained in the next section the standard operating gauge pressure is a variable depending on surrounding temperature. The standard reference gauge pressure used to calibrate the present models is 2⅜ in. of water for a surrounding temperature of 60° F.

Zero Pressure Position: Since the physical characteristics of the resonator and other metal parts of the instrument change slightly with surrounding temperature it is necessary, if extreme accuracy is required, to provide a means by which the combined effects of these changes on the accuracy of the instrument can be eliminated. This is accomplished by fitting the vertical section of the gauge glass with a scale (18) graduated to indicate zero water pressure positions for surrounding air temperatures from 30° to 100° F. In other words, graduations on this scale have been empirically determined so that the operating pressure can be changed the amount necessary to offset any error in the indicated specific gravity caused by changes in the instrument due to changes in surrounding temperature.

Gas Temperature: The temperature of the gas being tested is indicated by a mercurial thermometer (19) the bulb of which extends into the gas stream near the whistle inlet.

Surrounding Temperature: The surrounding temperature is indicated by a mercurial thermometer placed in such a position that it indicates the temperature of air surrounding the whistle and resonator.

Features and Applications: A gas gravitometer based on the principle and operated in accordance with the information given in this paper has certain highly desirable features and applications, the most important of which are as follows:

1. A source of power external to the instrument is not required.

2. It is a light weight, low cost, self-contained, easily portable instrument.

3. Its accuracy is not appreciably impaired by surrounding conditions, including changes in the barometric pressure, and the purity, temperature and humidity of the surrounding air.

4. With reasonable care in the manipulation of the whistle and in the interpretation of results the difference between the true specific gravity of a gas and that obtained by the use of this gravitometer will be less than 1%.

5. Its calibration can be verified or adjusted in a few minutes by use of a gas of known specific gravity.

6. The specific gravity of a gas can be determined in about one minute after the gas reaches the whistle.

7. It can be so constructed that only one instrument would be required to cover the complete range of gas specific gravities.

8. One of the important jobs for which this gravitometer is particularly adapted is the field determination of gas specific gravity.

9. This instrument does not make use of small orifices or other devices the efficiency of which may be impaired by small amounts of material usually suspended in gas during its processing or manufacture. Hence it provides a means by which gas specific gravity spot tests can be made with the speed and accuracy required for plant control purposes.

10. Other important uses for the instrument would be in connection with the purging of gas mains, gas storage holders, and other gas containers and for checking fuel gas and gas-air mixtures.

Regulations for Disposal of Canadian Properties

REGULATIONS for the disposal of petroleum and natural gas rights on Crown property in the Yukon and the Northwest Territories were announced recently by the Canadian government in an order-in-council issued from Ottawa.

Under the regulations, it is possible to take out up to eight permits to conduct exploratory work, with the maximum area for a permit being 256,000 acres and the minimum 64,000 acres. Acreage held must be reduced after the fourth year until a maximum of 1,000,000 acres may be held under permit after six years.

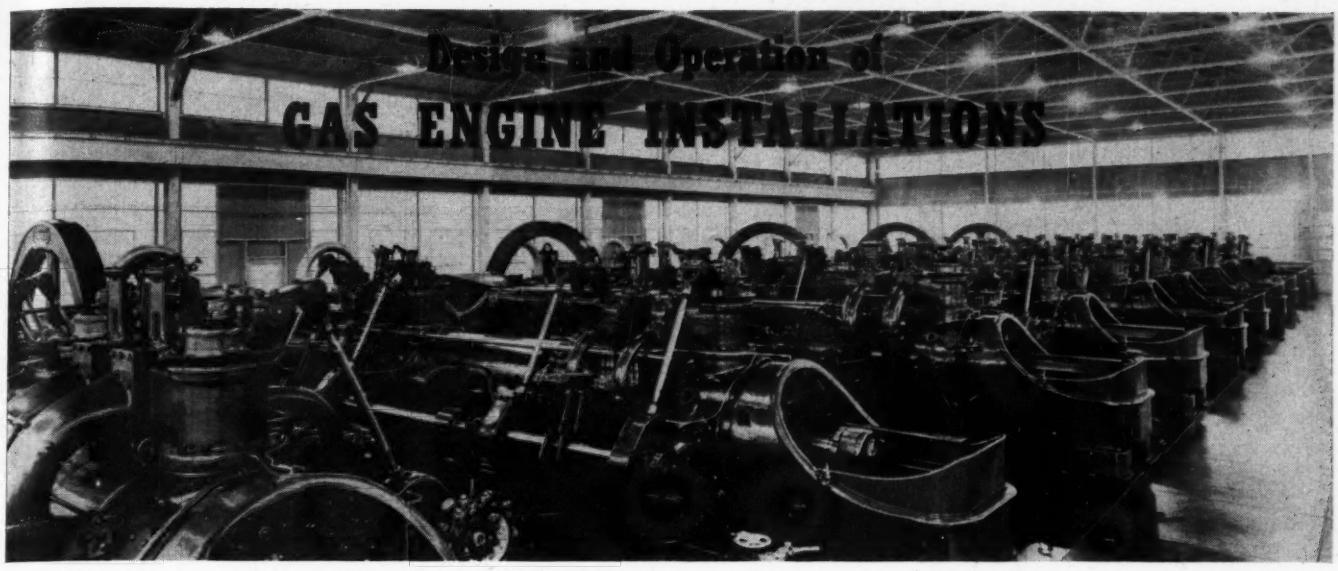
Besides a small application fee, each request for a permit must be accompanied by a deposit or guarantee bond to the value of 20c for each acre. Exploratory work carried out by the permittee at least must equal in expenditure the amount of money on deposit.

Under a clause aiming at elimination of wastage, the regulations say that whenever a stratum penetrated in a well is capable of producing natural gas in commercial quantity or is known to be likely to yield it in such quantity, the lessee shall confine such natural gas to its original stratum until such tme when such gas can be produced and utilized without waste.

In addition, another section says that the production of natural gas from any well shall be restricted to the market demand and in no event shall the production exceed 25% of the open flow of the well. Operators, too, are forbidden to produce natural gas from any well classified by the Minister of Lands and Mines as a producer of petroleum, in excess of the amount needed to produce such petroleum.

NFPA Publishes Paper On Compressed Gas Containers

The July Quarterly of the National Fire Protection Association features a valuable, illustrated technical paper, "Large Spherical Compressed Gas Containers," presented at the 1944 annual meeting of the NFPA by J. B. Smith, Associated Factory Mutual Fire Insurance Companies The article contains important data on the structural failure of a holder in Schenectady, N. Y. Copies may be had from the Association, 60 Batterymarch St., Boston, 10, Mass., at 25c each. Mr. Smith also collaborated with A. L. Brown in the preparation of an article on the same subject, entitled "Failure of Spherical Hydrogen Storage Tank," which was printed in the June, 1944, issue of Mechanical Engineering.



By BRUNO THIEL
The Cooper-Bessemer Corporation

THE present article is published with the thought that it might be helpful to operators in designing compressor stations for long range efficiency.

Compressor Station Buildings. Foundations: In order to give a clear picture of what a modern gas engine compressor station would consist of, the following description is given. The base for all compressor foundations should be a mat extending under and beyond all compressor foundations unless these foundations rest upon solid rock, in which case the foundations should be insulated from the rock by some vibration dampening material such as cork. The mat should be large enough to extend to within a foot or so from the building foundations, but should never extend to or under the building foundations, as this would transmit any engine vibration to the building walls.

If the ground at the station site is insecure, piles should be driven to solid ground with the outside row of piles sloped with their tops toward the center of the mat. The tops of these piles should be incorporated in the bottom of the mat by means of reinforcing steel. This will prevent, as much as possible, transmission of the engine vibrations to adjacent structures. All of the compressor foundations in any one building should be set on the mat in that building and securely anchored to it. This is the best means of breaking up any horizontal shaking forces, as the shaking forces of one unit will have a tendency to counteract the forces of another unless all units are synchronized with each other, a condition which does not exist in a compressor station except for short periods of time. The lower or tension side of the mat should be well reinforced, and keys should be cast into the top of the mat at those surfaces where the compressor foundations are to rest so as to tie the mat and the compressor foundations into one solid mass.

The question of whether or not to have a basement in a compressor station has been discussed pro and con for many years, but the convenience of a basement outweighs any additional cost that may be caused by its construction.

The station basement should be built high enough and the basement piping be so arranged as to allow plenty of head room and working space around the piping, and provided with facilities for proper ventilation. Most basements are now built with but half of their height below ground level which allows for the installation of full size windows in the basement and makes it available for storage of spare parts and operating stores such as oil and waste. Room for placing a bench for light repair work can also be found in the basement, making it handy for the repair crew on rush repair jobs.

The compressor foundations should be keyed into the mat and well reinforced at all points subject to tensile stress. All foundation bolts should be surrounded by a pipe or duct, diameter of which is at least 2.5 times the diameter of the bolt and extends into the foundation for a distance of at least 15 times the diameter of the bolt. These ducts should be kept free of concrete when the foundation is poured. This is done to facilitate lowering of the engine base over the foundation bolts. On the large horizontal units where the foundation bolts are very long the duct runs down to the foundation washer so that the bolt can be removed when the engine main frame is skidded onto the foundation. The foundations are generally built with a step or shelf in them approximately 14 in. below the floor line which acts as a support for the floor beams. A step or shelf may also be put in the building wall foundation for the same purpose. When the floor is poured, a strip of insulating material such as pitch impregnated felt at least 1 in. thick is put between the edge of the floor and the foundations. This prevents any horizontal forces from being transmitted from the engine foundation to the building wall. By judicious spacing of the foundations no additional supports for the engine room floor will be necessary in the basement, leaving all basement passageways unobstructed.

When grouting an engine the grout should never exceed 1½ in. in thickness and should be practically the same thickness over the entire foundation top. This eliminates excessive and uneven shrinkage, which might throw the unit out of line after the grout has dried. All leveling wedges and plates should be removed after the grout has set.

Piping: In the past the amount of gas delivered by a compressor station has been used as a basis for

THIS ARTICLE on compressor station design is a companion piece to the article by LYMAN F. SCHEEL, Union Oil Co., Orcutt, Calif., which was published in the May, 1944 issue of GAS, page 41. In that article Mr. Scheel took up points in compressor station operation, covering such subjects as fuel supply, ignition system, lubrication, jacket water, air cleaners, exhaust mufflers, alarms, and mechanical maintenance.

calculating the pipe sizes used in that station. This method of calculation assumes that the gas is flowing in a continuous stream from the compressor during the time it is in operation. What actually happens is that the compressor takes in gas during only a portion of its entire stroke and discharges the gas during only a portion of the next stroke, the amount of gas taken into the compressor cylinder and delivered by it during one revolution being dependent upon the volumetric efficiency of the compressor cylinder. However, the rate at which the gas is taken in or discharged depends upon the velocity of the piston during the time the gas is flowing to or from the compressor cylinder.

For example, in a double acting compressor cylinder having a piston displacement of 100 cu. ft. per minute when operating at a speed of 300 rpm., and having a volumetric efficiency of 85% during the suction stroke and a volumetric efficiency of 35% during the discharge stroke, the cylinder will then take in .2833 cu. ft. of gas during one revolution of the crank and discharge .1167 cu. ft. of gas during the same period.

If the compressor cylinder driving mechanism has a crank to connecting rod ratio of 1 to 5, the time consumed during the suction stroke, measured in the time of one stroke, will be 72-14% of the forward stroke and 76.74% of the return stroke or 74.44% of the time of one revolution. As the time of one revolution is .003333 minutes, the time required for the compressor cylinder to take in .2833 cu. ft., which is the quantity of gas taken in during one revolution, is .002481 minutes. Then the average rate at which the compressor cylinder takes in gas is 114.3 cu. ft. per minute. This means that the suction pipe leading to the compressor cylinder must be capable of handling gas flowing at the rate of 114.3 cu. ft. per minute instead of 85 cu. ft. per minute, as 114.3 cu. ft. per minute is the average rate of flow to the compressor cylinder during the time that it is taking in gas. If the pipe is calculated on 85 cu. ft. per minute it will have 74.4% of the proper area. In the same manner we find that this compressor cylinder will discharge gas during 40.44% of one revolution or .001348 minute during which time .1167 cu. ft. are discharged at an average rate of flow of 86.6 cu. ft. per minute. A discharge line based on the discharge capacity of 35 cu. ft per minute would have 40.4% of the required area.

If the pipes leading to and from a compressor cylinder are too small, the pressure drop through these lines will decrease the capacity of the compressor cylinder and will increase the power to compress a unit volume of gas. This is often the reason why compressor stations which are correctly designed so far as compressor horsepower and capacity are concerned do not deliver their rated capacity or are overloaded when put into operation.

The intercoolers in a two stage installation and the after-coolers in any installation should be calculated for pressure drop using the average rate of flow as outlined above. A restriction here can cause as great a power and capacity loss as too small a pipe size. In a station containing more than one compressor the headers connecting these compressors should be large enough to take care of the gas flowing to or from the compressor cylinders when all units are synchronized basing the rate of flow upon computations similar to those given above. If this is not done, the capacity of the station will be decreased and the horsepower per unit volume increased. Horsepower losses have reached as high as 33% of the productive horsepower in some instances where the piping was known to be undersize. Where two or more compressor cylinders on the same service are mounted on the same unit, the installation of a large header supplying all of the cylinders will increase the efficiency of the unit. On single cylinders the installation of an intake and a discharge tank will increase the compressor efficiency and also tend to mitigate any pulsations set up by the compressor.

Theoretically it requires less horsepower to compress gas in a two stage compressor than in a single stage compressor for any set of conditions, but due to the additional mechanical friction and valve losses this is not true actually. The two stage horsepower curve lies above the single stage curve until approximately 4.5 compressions are reached and from this point the two stage installation will require less horsepower than the single stage. However, the dividing line between single and two stage compression in any particular installation depends not only on the installed horsepower but also on the economies of the installation and this in turn depends upon so many variables that it is a lengthy problem in itself.

Compressor Station Buildings: The use of medium speed engines for driving compressor cylinders has decreased the size of the building necessary to house the main units in a compressor station. Taking a 6000 hp. main line station consisting of six 1000 V type engines as an example, we find that the floor space required is .7563 sq. ft. per hp. and the cubic content required is 12.634 cu. ft. per hp. In this arrangement we have allowed 10 ft. between the end engines and the end wall and a 5-ft. alleyway around all units. The same horsepower in slow speed engines would require 1.737 sq. ft. per hp. and 24.313 cu. ft. per hp. Then, too, there is quite a saving in concrete in the engine foundations, the medium speed engine requiring 140 cu. yd. and the slow speed engine 250 cu. yd., a saving of 90 cu. yd. or 36%.

The standard main line station building generally consists of a steel framework resting on a solid concrete basement wall that is carried up to the main floor level. The basement floor is generally not more than 4 ft. below the grade line which allows the compressor piping to come out of the station above grade. The outside headers are then laid on concrete supports and all outside valves are in plain sight of the station operators. Catwalks are built to each valve for the convenience and safety of the operators. A solid brick wall is carried from the floor to the top of the window sill and corrugated transite is used for the rest of the wall and roof. The windows are steel sash ventilating type and should be as air tight as possible, Although considered a needless expense by some operators, an overhead crane of some sort is essential in reducing the maintenance cost. This crane should have a capacity of not less than two tons.

The heating of a compressor station building can be done by an exhaust gas furnace or boiler that is supplemented by a gas or oil fired boiler for emergencies. In the dust bowl region some stations are supplied with water washed air which has considerable bearing upon the maintenance cost of units in this region. Another innovation is the placing of the motor driven water pumps in a dog house at the cooling tower and having them remote-controlled from the switchboard in the auxiliary house. This decreases the length of the water lines and also decreases the size of the auxiliary building. The auxiliary building is of the same general construction as the main building but does not have a basement. In it are the auxiliary engines direct connected to generators, the air starting compressors, the station office, spare parts and supplies store room, lockers, and wash room.

ASSOCIATIONS

P.C.G.A. Holds 51st Convention

THERE were two gold medals presented at the annual banquet of the 51st annual convention of the Pacific Coast Gas Association at the Ambassador Hotel in Los Angeles on Sept. 13.

And it was significant that these were committee awards going to H. L. Masser, chairman of the Association's Committee for Industry Development, and to W. M. Jacobs, chairman of the Postwar Appliance Committee—significant because it revealed that great strides have been made in cooperation between utilities and between utilities and manufacturers—signifcant also because these awards were concrete evidence that something had been done about the postwar problems of the gas industry.

President E. L. Payne opened the first general session before the Manufacturers Section with a review of the Association's accomplishments of the past year, of its objectives for the year ahead. As a manufacturer (president of Payne Furnace & Supply Co.), he expressed a hope that the closer affiliation and greater understanding between utilities and manufacturers established by the war would continue in the years ahead.

Further evidence that the gas industry was on the march was seen in the addresses of John I. Yellott, director of the Institute of Gas Technology and of H. Vinton Potter, director of the A.G.A.'s coordinated kitchen program. These men, both forceful speakers, drew capacity audiences, and outlined in detail the progress that has been made and that is being planned in their respective fields. For a complete story by Mr. Yellott on the Gas Institute see G A S, Sept., p. 24.

Mr. Potter in his address before the combined sales, advertising and home service delegates, stated that there were now 17,000,000 obsolete ranges of all types. The selling of this market, however, was not only a matter of competition between fuels and types of ranges, but also of competition from other types of obsolete appliances ranging from 23,000,000 radios to 3,100,000 washing machines.

To summarize, Mr. Potter stated that a number of things could be done to better our postwar selling approach:

Col. W. F. Rockwell at the speakers' stand with PCGA president **E. L. Payne.** Also shown, **Franklin S. Wade,** president, Southern California and Southern Counties Gas Companies.

President-elect O. R. Doerr

1. Redesign sales floor displays: show modern appliances in a modern kitchen, paying attention to detail; cooperate with other industries, such as cabinet makers, linoleum suppliers, the steel, aluminum, and plastic industries.

2. Advertise: establish gas as the *magic* fuel of the future. Recognize the fact that gas fuel dispenses its heat in the form of a flame; capitalize and glamorize on this.

3. Recognize the CP range! Do everything possible to educate the dealers and the public as to the quality and performance of this appliance.

4. Make pictures of gas appliances and gas kitchens available to the public through advertising and other means. Women all over the country are keeping scrap books toward the day when they will build a new home. It is the industry's job to see that gas plays an important part in those scrapbooks.

5. Build a well trained and sufficient sales force.

Turning to the subject of kitchen ventilation, Mr. Potter said that this will be necessary because of the postwar trend toward smaller houses, better insulation, pastel decorations, and use of appliances that will both heat and cool.

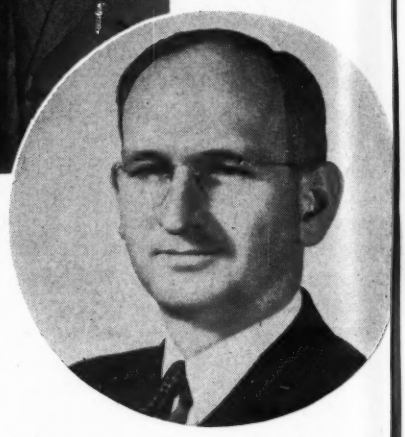
Plans for kitchen ventilation call for a flued cabinet over the range. This device would draw the air out by means of a fan operated with the gas valve.

Speakers at the first general session, which was devoted to the Manu-

At PCGA's 51st Meeting

John I. Yellott, director of the Institute of Gas Technology, **Geo. H. Smith,** assistant managing director of A.G.A., **C. L. Brockshmidt** of the OWU, WPB, and **A. H. Sutton,** president, Mission Water Heater Co. and chairman of the Manufacturers' Section.

H. L. Masser, chairman of PCGA's committee for Industry Development received a Gold Medal committee award.



W. M. Jacobs, chairman of PCGA's Postwar Appliance Committee, which won the second gold medal award.

Leroy M. Edwards, Pacific Lighting vice president and general manager, spoke on manpower problems and the part that the gas industry has played in war production in Southern California.

H. W. Geyer, Southern Counties Gas Co. who spoke on variations in gas supply, meets with **Elting Henderson,** chairman of PCGA's technical section.

From Coast Counties Gas and Electric Co. came vice president and general manager **H. W. Edmund,** vice president-elect of PCGA and president **H. L. Farrar,** former PCGA president

GAS CAMERA

Left: Two former presidents: Pacific Gas and Electric Co.'s **R. S. Fuller** of PCGA and Southern Counties **Arthur F. Bridge** of A.G.A. Center: **W. R. Teller,** assistant director A.G.A. Laboratories, Cleveland. Right: **Frank C. Packer,** assistant to the president, Payne Furnace and Supply Co. and chairman of the PCGA convention arrangements committee, is flanked by two pretty Grayson Heat Control girls—**Barbara McAvoy and Velda Fouts.**

facturers Section, were A. H. Sutton, Manufacturers section Chairman A. B. Striker, who spoke for O. R. Doerr, PCGA vice president, and two Washington representatives, Leonard Macomber, AGAEM (see page 20) and W. C. MacDonald, deputy director of the Plumbing and Heating Division, WPB.

The meetings of the Manufacturers Section, which brought together 200 executives from 67 related companies, were described by Chairman Sutton. The Section is collecting monthly progress reports for heating manufacturers and is engaged in many other activities of mutual benefit to themselves and to the utilities. The Section was again awarded the Basford Trophy for its outstanding contribution to industry progress.

President-elect Doerr's address brought out a five-point program based on (1) adequate gas supply; (2) a better job of selling gas as the ideal fuel: (3) more advertising, national, regional, and local; (4) clean gas delivered through quality appliances; (5) cooperative policies of sales promotion and service with all other interested industries.

Excerpts from the addresses of two Eastern delegates, Leonard Macomber of AGAEM and George H. Smith, assistant director of AGA, are reproduced elsewhere in this issue.

Final speaker at the first day's general meeting was W. C. MacDonald, deputy director, Plumbing and Heating Division. WPB, who, among other things, said:

> "During the first five months of this year we have been able to eliminate some 50 orders and make less restrictive approximately 150 more. Our policy is, and will be, to remove the restrictions as promptly as practicable. In this connection, I think you will be interested to know that in several instances where the 'bureaucrats' in the WPB have been anxious to lift an order, the industry involved has opposed it. They have opposed it usually on the grounds that removal of the controls would benefit one company or another—in other words, while professing a desire to return to free enterprise in general, they were not reconciled to its immediate disadvantages. This is a dangerous thing and fortunately is not general. If we are to have an opportunity to return to a system of free enterprise, war time controls must be promptly removed."

The first day's session closed with the election of officers with O. R. Doerr, general sales manager for Pacific Gas and Electric Co., and H. W. Edmund, vice president and general manager of Coast Counties Gas and Electric Co., being elected president and vice president, respectively.

The Political Picture

As might be expected at this critical time there were a number of addresses devoted to the general political and economic situation, all of them pessimistic.

Col. W. F. Rockwell, author of the Rockwell Plan (see page 83) of postwar unemployment compensation for war workers, spoke before the first general luncheon. Warning that the "sneak attack" is on, and that the political army of the Potomac may continue to dominate every man's life, the Colonel said:

> "Never in the history of our country has there been a more desperate need for sane, practical guidance in the planning that will influence our lives after this war is over. As many times as we have trembled on the economic brink, never before have we faced the dire prospects we do now with the coming of peace. . . .
>
> "Now in the interest of preserving our high standards of American life, our social gains and even our Democratic structure, business must change its attitude and accept the individual responsibility of supplying practical guidance to our legislators."

Los Angeles County has become the No. 1 war production center, said Leroy M. Edwards, vice president and general manager of Pacific Lighting Corp., before the convention's second general luncheon. This rapid growth in a restricted area has brought many problems, which from the utility standpoint may be summed up in furnishing an adequate supply of gas at rates that will permit high quality service and assure the investor that his money is safe. Turning his attention to the regulatory bodies, Mr. Edwards said:

> . . . "We are all striving toward the same goal—the welfare of our community and of the citizens whom we serve, be they consumers of our gas or investors in our business. A regulatory commission can point with far greater pride to an excellent standard of utility service than it can to rates that are unduly low. Poor service is expensive at any price. Good service is worthy of appropriate reward."

Still another phase of the economic situation was touched upon by L. M. Klauber, vice president and general manager, San Diego Gas Co., that of the three-fold problem of termination of war contracts, disposition of surplus supplies and commodities, and disposition of war factories.

The problem is serious as it involves 105,000 prime contracts; 500,000 subcontracts, and over 20,000,000 workers. While something has been done, no definite decision will be coming from Congress prior to the election. Unless care and judgment are shown in the disposition of the war plants, we may very well find that the government is in business with the most modern and tax-free plants competing with an outclassed private industry.

Klauber particluarly warned against the policy of allowing the government to retain "yardstick" plants. Citing the Muscle Shoals as an example, he pointed out that in 1918, $13 million were invested for making nitrates: in 1923, $40 to $50 million for completion: that today it is the nucleus of TVA, a $700 million project. This trend was hardly in keeping with an avowed government policy of staying out of business.

The panel meeting of the sales group featured the address by H. Vinton Potter and a review of the work of the Postwar Appliance Committee by Chairman Jacobs. Trends in commercial and industrial appliances were discussed by E. H. Adler of San Diego, while "New Appliances in New Fields" was the subject of Frank Weiss.

Purity, or lack of it, and variation in the gas supply was the general topic discussed by the technical group. Advantages in uniformity of gas supply were pointed out by Frank C. Packer of Payne Furnace while H. W. Geyer got down to cases in discussing the operation of appliances under conditions of variation in gas supply.

The subject was further enlarged upon by Frank Wills of Pacific Gas and Electric Co., who discussed latest data on the sources, occurrence, and means of removal of dust. He made the point that there is as much dirt in some air as there is in dusty gas.

Two other papers rounded out the technical meeting. R. W. Todd and A. B. Polley, of Pacific Lighting Corp., presented an illustrated paper on modern methods of reconditioning large diameter pipe.

Featured speaker at the Manufacturers' Section panel meeting was W. R. Teller, assistant director, AGA Laboratories, who enlarged upon and brought up-to-date the material presented to the industry in the early part of the year.

The Home Service section had a breakfast and an afternoon meeting under the direction of Marguerite Fenner of Pacific Gas and Electric Co.

First prize in the annual Women's Committee yearbook contest went to the San Joaquin Valley division of Pacific Gas and Electric Co., Kathryn Yoksh, chairman.

Utilities Rank High in Treasury Display Contest

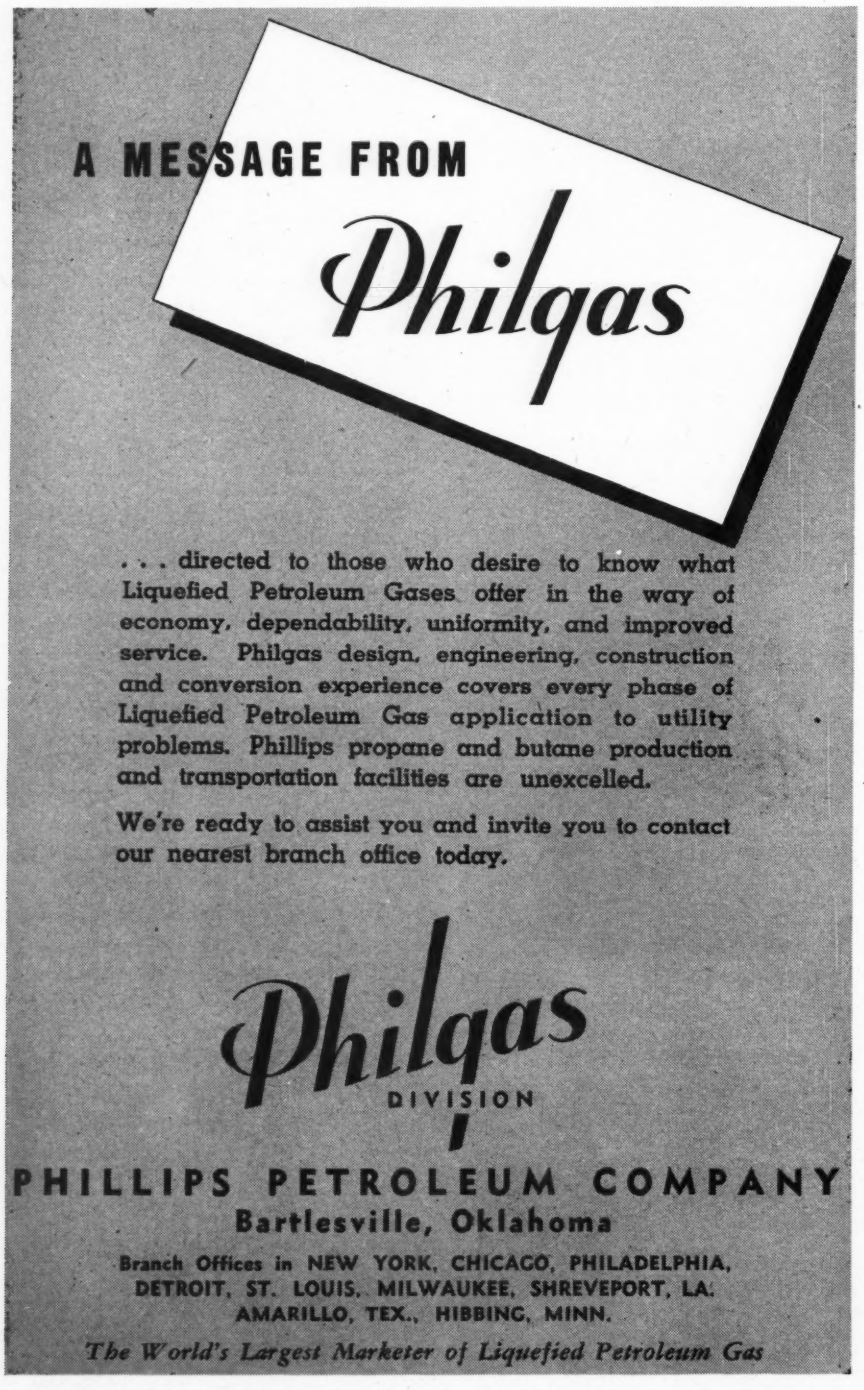
TWELVE member companies of the American Gas Association won citations in the recent Treasury-approved National Display Contest sponsored *during the Fifth War Loan* Drive by the National Association of Display industries and *Display World*, according to George W. Browne, chairman, Window and Store Display Committee, A.G.A.

There were more than 2000 entries from every state in the Union and Hawaii, 200 of these receiving Treasury citations. Plans are now under way for a more comprehensive display contest to be held in conjunction with the Sixth War Loan.

A third prize of $200.00 was awarded M. R. Norton, Wisconsin Power and Light Co., Fond du Lac.

Citation award winners were as follows:

E. Russell Smith, Central Illinois Light Co., Springfield, Ill.; John T. Gorts, Fitchburg Gas & Electric Co., Fitchburg, Mass.; E. V. Haight, Northern States Power Co., Eau Claire, Wis.; Howard Whelpley, Pacific Power & Light Co., Yakima, Wash.; Howard E. Martin, Empire District Electric Co., Joplin, Mo.; Aime J. Paulhus, Blackstone Valley Gas & Electric Co., Woonsocket, R. I.; G. Martin Storck, South Carolina Electric & Gas Co., Columbia, S. C.; Leon Longmire, Central Illinois Light Co., Peoria, Ill.; E. R. Laws, Philadelphia Electric Co.; Brooklyn Union Gas Co., Brooklyn; Roy H. Heimbach, Michigan Consolidated Gas Co., Detroit.


A MESSAGE FROM
Philqas
. . . directed to those who desire to know what Liquefied Petroleum Gases offer in the way of economy, dependability, uniformity, and improved service. Philgas design, engineering, construction and conversion experience covers every phase of Liquefied Petroleum Gas application to utility problems. Phillips propane and butane production and transportation facilities are unexcelled.
We're ready to assist you and invite you to contact our nearest branch office today.
Philqas
DIVISION
PHILLIPS PETROLEUM COMPANY
Bartlesville, Oklahoma
Branch Offices in NEW YORK, CHICAGO, PHILADELPHIA, DETROIT, ST. LOUIS, MILWAUKEE, SHREVEPORT, LA. AMARILLO, TEX., HIBBING, MINN.
The World's Largest Marketer of Liquefied Petroleum Gas

Furniture Ass'n To Print Store Modernization Book

Responding to a widespread demand by retail merchants of the country for information on store modernization, the National Retail Furniture Association is sending to press a book which will contain the results of an exhaustive survey on store design from the research laboratories of industry and the recommendations of leading commercial architects.

The book is compiled as a manual in which each phase of modern store designing will be outlined to guide retailers in crystallizing their ideas for revamping their stores to meet the requirements of the postwar period. Illustrated designs for store fronts, windows, interiors, displays, elevators, air conditioning, heating, fire protection, equipment, service departments and receiving and shipping spaces will be shown.

ICC Quarterly Meeting Scheduled for October

The quarterly meeting of the Interstate Oil Compact Commission has been scheduled by Governor Andrew F. Shoeppel of Kansas, chairman of the Commission, for Oct. 5, 6 and 7, at the Biltmore Hotel, Oklahoma City, Okla.

On the program are such vital subjects as the British-American oil agreement, responsibilities of the states in postwar regulation of oil industry, and the rapidly growing West Edmond oil field, according to announcement by E. G. Dahlgren, acting secretary of the Commission.

With its membership embracing 13 oil and gas producing states, quarterly meetings of the Commission attract national attention, and the attendance of several governors of member states.

Baxter Named President Of Arkansas Association

The following officers were elected at the recent annual meeting of the Arkansas Utilities Association:

L. L. Baxter, president of the Arkansas Western Gas Co., Fayetteville, president; C. L. Leighton, Arkansas division manager of the Arkansas Louisiana Gas Co. at DeQueen, first vice president; C. H. Thorp, Arkansas Louisiana Gas Co., Little Rock, second vice president, and R. E. Ritchie, vice president of Arkansas Power & Light Co., Little Rock, re-elected secretary-treasurer.

Safety Meeting Planned

The public utilities section of the National Safety Congress will sponsor a gas industry program Oct. 5, under the chairmanship of E. S. Miner. The Congress will take place Oct. 3-5 at the Sherman, Morrison and LaSalle Hotels, Chicago.

NEW PRODUCTS

Warm Air Heater

Dravo Corp., 300 Penn Ave., Pittsburgh, Pa.

Model: Small Direct Fired Heater.

Application: Designed to meet the problem of heating small structures and providing additional heat for limited areas. The company is now supplying to the armed forces to heat steel service igloos at advanced bases. Suitable for supplying warm air to remote parts of factories.

Description: The unit has capacities ranging from 300,000 to 850,000 Btu output per hour. Over-all size has been proportionately reduced, floor space requirements being just 5¼ in. x 3 in., and it may burn either gas or oil. Heater is thermostatically controlled.

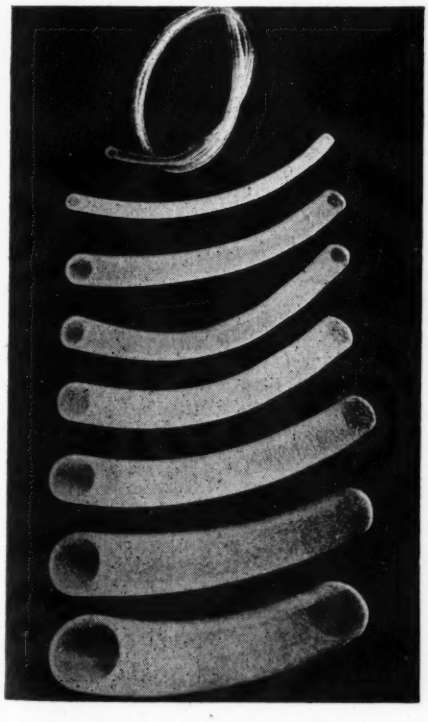
Solvent-proof Tubing

Resistoflex Corp., Belleville, N. J.

Product: Transparent compar laboratory tubing.

Application: A transparent laboratory tubing which permits constant inspection of its contents. Because it is tough, strong, and completely inert to almost all organic solvents, it is highly useful for low pressure, room temperature handling of these hard-to-handle materials. Does not absorb the protective odors with which illuminating gases are usually loaded and hence prevents their contamination of the laboratory atmosphere.

Transparent compar tubes filled with mercury are used by aircraft manufacturers to observe and to record by motion picture the behavior of flight instruments during test flights.



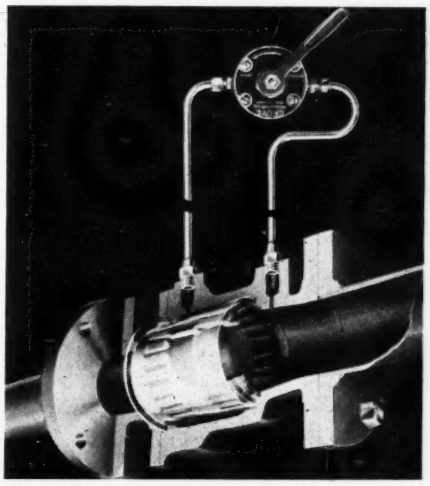
Description: A solvent-proof, rubber-like and transparent tubing, made of compar, a special type of vinyl resin. Not affected by such solvents as carbon disulphide, carbon tetrachloride, trichlorethylene and other active solvents used in ordnance and aircraft work, or by such gases as freon, methylchloride, phosgene, mustard, propane, butane, etc. Tough and strong, but not generally recommended for industrial applications which now employ fabric reinforced host constructions containing tubes or cores of other compar formulations.

Remote Control Valve

Grove Regulator Co., 6481 Green Street, Oakland 8, Calif.

Model: Grove Flexflo Remote Control Valve.

Application: Designed for cold fluid service, and especially suited for handling water, salt water, chemical solutions, oil, gases, and air.



Description: An "expansible tube type" valve, operating by manual or automatic remote control on the hydraulic principle. Its simplified assembly consists of four parts: valve body, flange head, a slotted pipe-like core with a solid barrier in the center, and a cylindrical flexible tube. The flanged ends of the tube serve as a leak-proof gasket sealing off an encircling pressure chamber from the flow stream. Full details are available from the manufacturer in Bulletin No. 800.

Damper

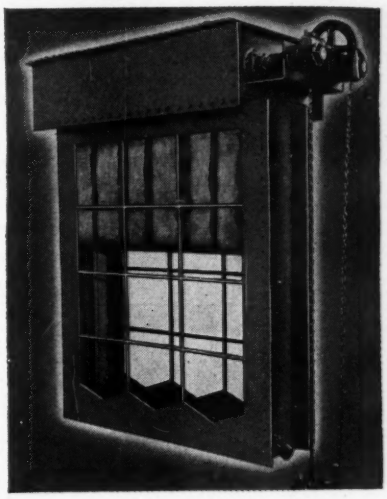
Thermix Engineering Co., Greenwich, Conn.

Model: Reverse Flow Heacon Damper.

Application: For regulating gas flow in either direction.

Description: The damper employs two curtains tied together mechanically so as to operate simultaneously, which permits flow in either direction regardless of the damper position.

With a damper of this type in a natural draft by-pass around fans, or in a heat or dust regulator equipment, complete isolation of equipment is provided for maintenance purposes, and elimination of recirculation gives increased capacity and heat absorption,



thereby reducing the maintenance of equipment under control. Banking losses are claimed to be reduced and accurate regulation of natural draft obtained. This damper type DVHR can also be used in cross-air ducts between forced draft fans.

Full details will be sent on request to the manufacturer.

Catalogs

Niagara Blower Co., 6 E. 45th St., New York 17, N. Y., has recently published a four-page mailing piece on their newly developed "Balanced Wet Bulb" Temperature Control for the Niagara Aero Heat Exchanger. Illustrations and diagrams demonstrate action of product, which manufacturer claims maintains uniform temperature of fluids for any process or equipment, using clean, outdoor air as a cooling medium the year around in any climate.

• **Thermix Engineering Co.,** Greenwich, Conn., has published a new, illustrated Heacon Damper catalog, providing data on modern industrial damper problems. Adaptable to practically any industrial requirements, manufacturer claims Heacon "Controlled Flow" Dampers provide complete and rapid control of air, steam, gases, etc., from absolute stoppage to full 100% flow.

• **Worthington Pump and Machinery Corp.,** Harrison, N. J. Bulletin L-675-B1 is a 28-page booklet describing Worthington's feather valve compressors. It includes sections on the feather valve, cylinders, intercooler, variable capacity control, lubrication, auxiliary equipment and many illustrations of specific appliactions.

• **Surface Combustion,** Toledo 1, Ohio, has isssued an 8-page leaflet, "Heat Treating Review,"—a pictorial presentation of the company's heat treating furnaces and heating machines which have recently been installed. It includes a variety of types and sizes of installations.

PIPELINE NEWS

• **United Gas Corp.** has applied to FPC for a renewal of authorization for the exportation of natural gas from Texas to the Republic of Mexico, for distribution in the City of Nuevo Laredo, Tamaulipas, Mexico and environs. The company plans to replace with a 6-in. pipeline a portion of its 4-in. pipeline from Laredo, Tex. to the International Boundary. It is claimed the new facilities are needed to provide for the delivery of increased quantities of gas to existing customers and proposed new customers of the Compania de Gas de Nuevo Laredo, S. A., in Mexico.

United Gas Corp has also negotiated and executed a new gas sales contract with the Compania de Gas de Nuevo Laredo, S. A., to supersede its present contract with that company.

Authorization is to terminate automatically upon the expiration of the contract but is subject to renewal if the Commission finds it is not inconsistent with the public interest.

• **William Bros. Corp.** is setting up an office at Claysville, Pa., where work will be directed by Thelma Davis, spread superintendent, for the laying of 30 miles of 16-in. natural-gas pipeline for **Manufacturers Light & Heat Co.** The line represents an unfinished section included in a program started several years ago.

FIREPLACE AND ROOM TYPE

HEATERS

Part of the PEERLESS Line for Peace

Now Available!

We are building some gas heating models **now.** Among them radiant heater (6485 W) pictured above, as well as wall heaters, vented and unvented circulators. These are forerunners of the complete line of gas heating equipment, from bathroom heaters to floor furnaces, we will build again as soon as war restrictions are lifted.

Ask for data on models now available

PEERLESS

MANUFACTURING CORPORATION

INCORPORATED

LOUISVILLE 10 KENTUCKY

• **Kansas Consolidated Gas Corp.,** an affiliate of Consolidated Gas Utilities Corp., of Oklahoma City, Okla., has an application on file for permission to construct 215 miles of 18-in., natural gas pipeline from west of Liberal, Kan., in the Hugoton gas field, to the Wichita area.

The line is designed to have an initial capacity of 86,000,000 cu. ft. per day. It was planned to relieve gas shortages in the Wichita area, due to war demands, but it is believed that the line will be necessary to fully meet expected increases in domestic, commercial and industrial demands even if the war in Europe should end before the line is built.

It is not now anticipated that the line will be built, if the application is granted, until during the 2nd and 3rd quarters of 1945, so no definite date has yet been set for hearing on the application.

The Consolidated Gas Utilities Corp. supplies and distributes gas in Wichita and other cities and towns in that area, also operates pipelines and distribution plants in northern and northwestern Oklahoma.

• **Memphis Natural Gas Co.,** a Delaware corporation with offices in Memphis, Tenn., has applied to FPC for authority to construct and operate additional facilities in Arkansas and Mississippi, as follows: 1. Three 18-in. lines approximately 61 miles and paralleling the unlooped portion of the company's existing natural-gas pipeline in Chicot County, Ark., and Bolivar, Coahoma and Tunica Counties, Miss. These facilities would increase the capacity of the existing system by 21 million cu. ft. per day, the major portion of which is proposed to be made available to the Memphis Light, Gas and Water Division of the City of Memphis. 2. In Louisiana, a 20-in. line approximately 50 miles long with a capacity of about 100,000 mcf of gas per day in substitution of its original proposal to construct a 12¾-in. line with a capacity of about 50,000 mcf per day. The proposed 20-in. line will have its termini at the company's Guthrie Compressor Station in Ouachita Parish, and in Claiborne Parish, La.

• Several new construction projects are in progress by **Zenith Gas System, Inc.,** Alva, Okla. Construction started early in July on a new 6 5/8-in. line from the company's main transmission system at Hardtner, Kans., to the Davis area gas wells at Aetna, Kans., a distance of 12 miles. The Alva border station has been removed to make room for a new million-bushel terminal elevator now being built, and the company has also just completed 4 miles of 8 5/8 in. line from Alva to its Cherokee, Okla., take-off, which replaces an older 6-in. line.

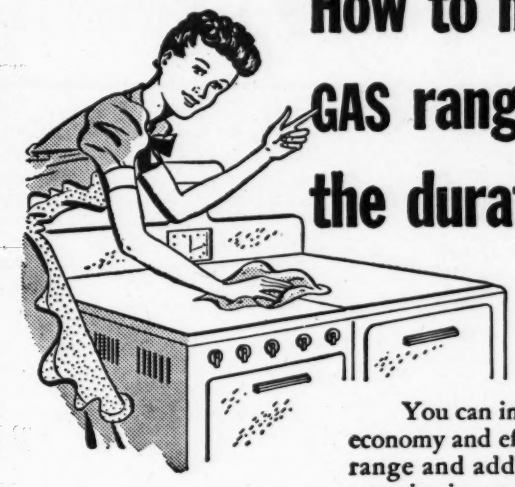
• FPC has announced a hearing for Sept. 11 on an application filed by the **United Natural Gas Co.,** Oil City, Pa., which seeks authority to construct and operate a 37-mile natural gas pipeline in western Pennsylvania. The proposed 12¾ in. line would begin at a point where gas would be delivered to it near The Manufacturers' Light and Heat Co.'s Ellwood City compressing station in Beaver County, and extend north to the applicant's Mineral compressing station in Venango County, Pa.

An Example of P·G and E's current GAS advertising appearing in 309 northern and central California newspapers

OUR THEME THIS MONTH

*Conservation of Gas & Care of Equipment

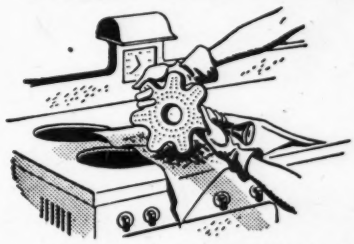
How to make your GAS range last for the duration...



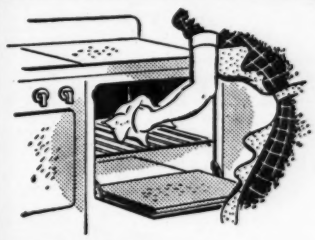
You can improve the cooking economy and efficiency of your gas range and add years to its life if you give it regular, systematic care.

How to Clean Enamel. Use a soft cloth to clean your gas range top after each meal. Never use a damp rag on a hot stove. For a thorough cleaning use mild soap and water, but only when the stove is cold. Wash and dry the enamel surfaces as you would a china plate.

How to Clean the Broiler. Wash your broiler pan each time after using. If this is not done, your broiler will smoke and the pan may become damaged beyond repair.



How to Clean Top Burners. Usually no more than a vigorous scrubbing with a stiff brush once a week will keep top burners clean and open. Never boil aluminum or enamelled burners in a soda solution.



How to Clean the Oven. Allow oven to cool off before cleaning boil-overs. Spillage when thoroughly dry is easily removed with a spatula, steel wool and cleansing powder. Keep oven sides and racks sweet and clean by occasional washing with soap and water.

Reasonable care will keep the porcelain enamel on your gas range looking like new. Be careful about spilling vinegar, tomato juice and fruit juices on your range. Wipe such spillage up at once with a dry cloth or paper towel. These fruit acids cause rings or dull spots that can never be removed.

With canned fruits rationed, your Gas Range is being used for more cooking hours than ever before. Treat it well.

P·G·and E·
PACIFIC GAS AND ELECTRIC COMPANY

PEOPLE

• **Guy B. Treat,** Oklahoma City, Okla., coordinator for the national fuel efficiency program in that area, in cooperation with the U. S. Bureau of Mines, has named the following advisory committee:

M. E. Orlup and **G. T. Donceel,** industrial engineers, Oklahoma Natural Gas Co.; **Cecil C. Willis,** superintendent of generation, and **W. H. Stueve,** chief power consultant, Oklahoma Gas and Electric Co.; **Gwynn Raymond,** chief engineer, Black Sivalls and Bryson, Inc., and **Louis Loeffler, Jr.,** Federal Supply Co., all of Oklahoma City.

This committee of engineers will assist the National Fuel Efficiency Control organization and the Bureau of Mines in a campaign to secure a 29,000,000 ton reduction in the nation's annual commercial and industrial consumption of coal and proportionate savings in other fuels.

• **Col. W. B. Tuttle,** chairman of the board and general manager of the City Gas and Electric System, San Antonio, Tex., has resigned as manager at his own request, though he will continue to serve as chairman of the Public Service board. In his 30 years' association with San Antonio utilities, he had served successively as general manager, vice president, and president of San Antonio Public Sevice Co., and had been chiefly responsible for the company's tremendous expansion. He had also engineered the substitution of natural gas from Three Rivers for manufactured gas, and pioneered the conversion of many appliances and devices to burn gas.

• **Charles E. Kohlhepp,** vice president and controller of Wisconsin Public Service Corp. since 1938, has been appointed general manager of the company. He takes over duties formerly supervised by J. P. Pulliam, who continues as president and a member of the board of directors. Another appointment made was that of **H. P. Taylor,** treasurer, to the position of vice president and treasurer.

• **Russell C. Wenz,** purchasing agent since 1939, when he joined the company, has been made general purchasing agent of the Philadelphia Co. and subsidiaries of Pittsburgh, and for the Trustees of Pittsburgh Railways and Pittsburgh Motor Coach System to succeed **Walter H. Arras,** retired. In 1943 he was appointed regional utility engineer for WPB and recently became consultant, inventory control, OWU. He is also eastern vice chairman of the Public Utility Buyers Group, National Association of Purchasing Agents. Mr. Arras joined Equitable Gas Co. in 1900 and subsequently served as assistant general purchasing agent for Philadelphia Co., and finally general purchasing agent.

• According to recent announcement, **E. H. Dixon** has been elected president of Electric Power and Light Corp., and **N. C. McGowen** president of United Gas Corp., a subsidiary. The new officers succeed the late **J. H. Gill,** who served as president of both companies.

N. C. McGowen

Prior to his new appointment, Mr. Dixon had been executive vice president of Electric Power and Light. Mr. McGowen, whose headquarters are in Shreveport, has been president of the principal subsidiaries of United Gas for many years and is a past president of the American Gas Association.

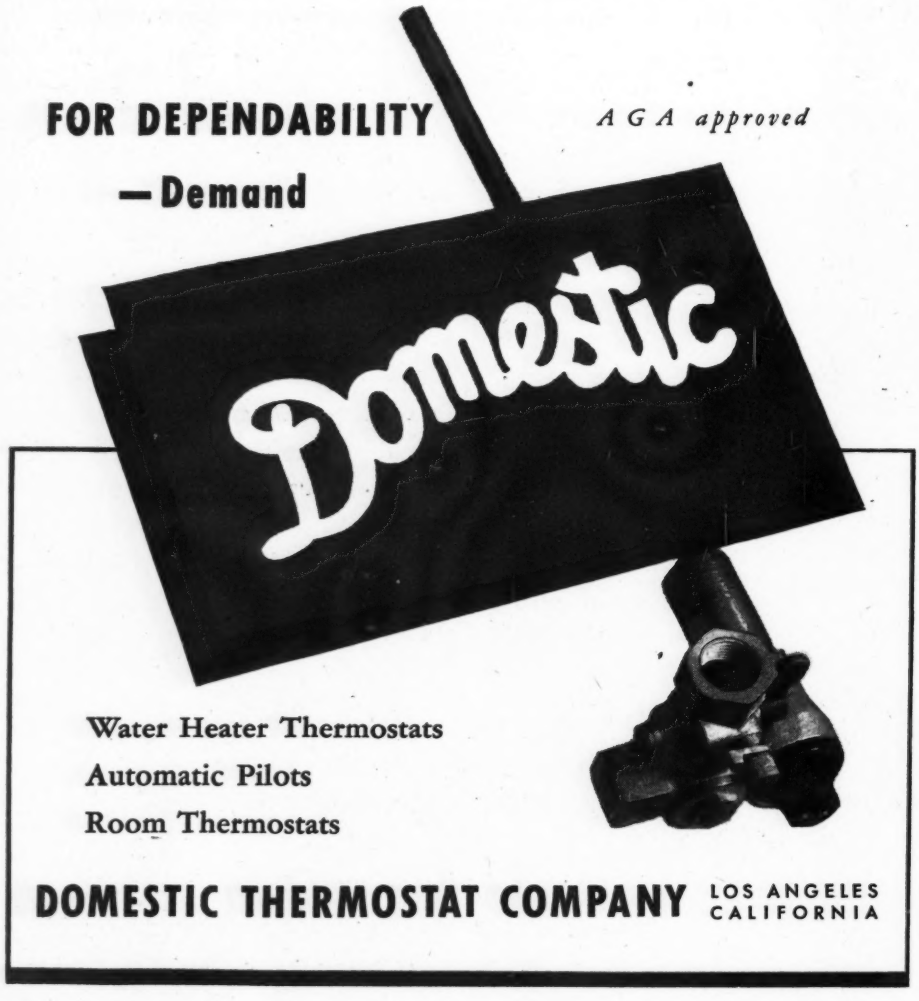
P. O. Canaday has been elected treasurer of Electric Power and Light and **R. H. Hargrove,** vice president of United Gas. **A. B. Paterson** of New Orleans Public Service, Inc., has been elected a director of both companies. **W. T. Wynn** of Greenville, Miss., and **C. J. Savoie** of Belle Rose, La., have been elected directors of United Gas. Mr. Hargrove has been nominated for vice president of the A.G.A.

• **H. J. Hazard,** secretary and treasurer since 1942, has been appointed resident manager of the Union Gas and Electric Co., Bloomington, Ill., according to a recent announcement by William E. Vogelback, president. Before joining Union Gas and Electric, he had served as assistant manager of the Van Wert Gas Light Co., Van Wert, Ohio, assistant superintendent of the Kentucky-Tennessee Light & Power Co., Bowling Green, Ky., treasurer of the Owensboro Gas Co., Owensboro, Ky., and secretary and treasurer of the Indiana Gas Utilities Co., Terre Haute, Ind. Another change in company personnel was the resignation of S. H. Osterhoudt as manager.

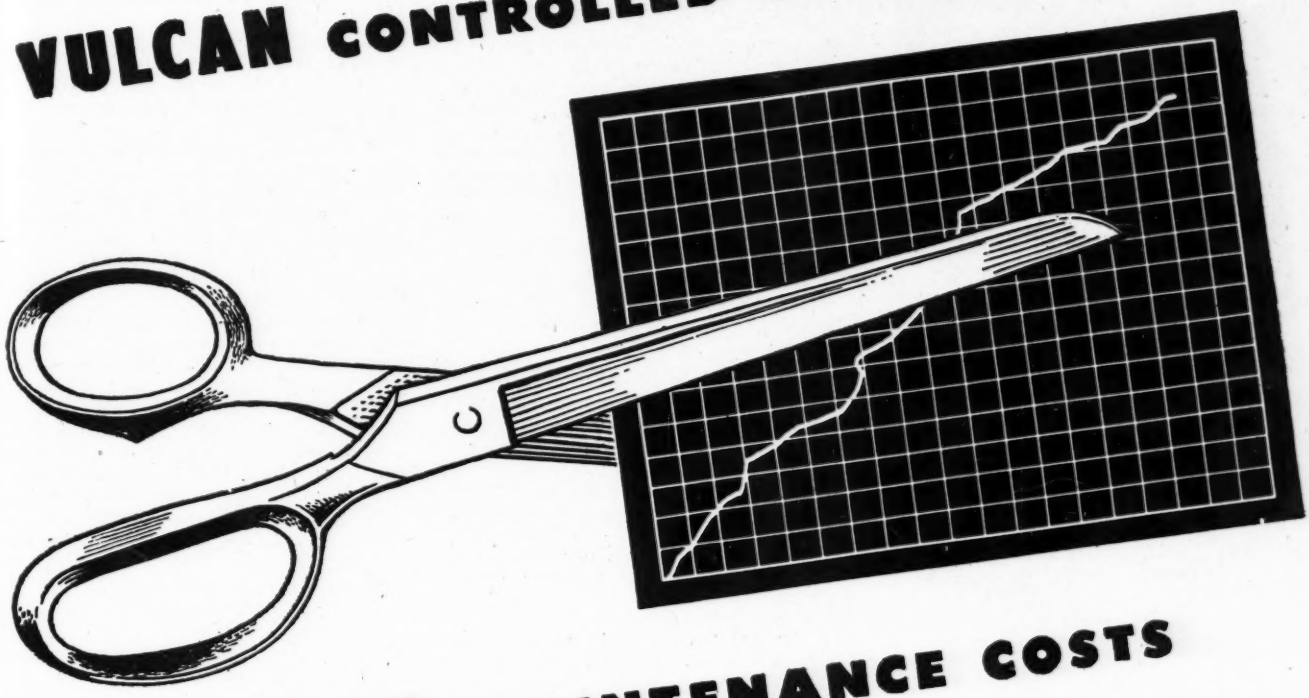
• **W. H. Newman** has been appointed executive officer of the Petroleum Administration for War in a move that places two PAW divisions under one head. He will continue to direct the work of PAW's Organization Planning staff with full responsibility for the review, determination and recommendation of changes in the basic operation of the agency. He will also perform the duties of executive officer, replacing **E. L. Kohler,** who resigned.

As executive officer, Newman, who is 34, is responsible for policies on personnel, budgets and other internal operating matters.

• It was recently announced that **Frances Harkness** has been made home service director for Canadian Western Natural Gas, Light, Heat and Power Co., Calgary and Lethbridge, Alt.



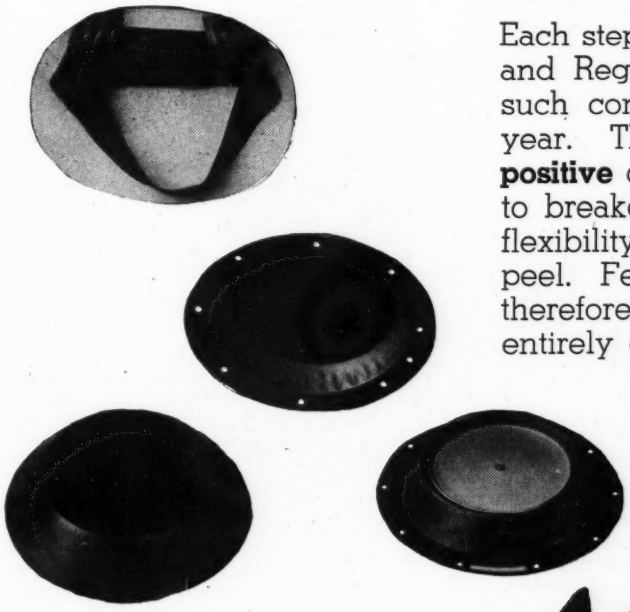
VULCAN CONTROLLED MANUFACTURE



CUTS MAINTENANCE COSTS

Careful Selection of Raw Materials . . . Chemical Testing of Compounds for Purity . . . Experienced Technical Supervision in Processing . . . Testing for Efficiency Under Actual Operating Conditions.

Each step in the production of VULCAN Meter and Regulator Diaphragms is **controlled,** and such control is rigidly maintained year after year. That's why the finished product has **positive** characteristics that make it impervious to breakdown in operation; why it retains its flexibility, and will not expand, shrink, crack or peel. Fewer replacements are necessary, and therefore **maintenance costs** are reduced—if not entirely eliminated over long periods of time.



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FIRST AVENUE AND FIFTY-EIGHTH STREET
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6325

Looking ahead, the P. C. G. A. has brought post-war problems into sharp focus. For many months, committees have worked to prepare the gas industry of the West for V-day and years to follow. ★

COMMITTEE ON APPLIANCES

Combining utility and manufacturer membership, the Post-war Appliance Committee has conducted contests and surveys that have brought out scores of ideas and suggestions. It has also sent comprehensive reports to manufacturers, suggesting lines of research for improvement of existing appliances, for the creation of new ones.

***Other* COMMITTEES ACTIVE**

The Committee on Sales Training and the Personnel Committee also have slanted their programs towards the peacetime future. ★ The keynote is *. . . planned preparedness.*

GAS FUEL

SERVING THE WEST IN WAR AND PEACE

THE PACIFIC COAST GAS ASSOCIATION

• **E. E. LeVan** has been elected president of Haynes Stellite Co., a unit of Union Carbide and Carbon Corp., succeeding the late **Francis P. Gormely.**

LeVan was graduated from Pennsylvania State College in 1917, with a degree in mechanical engineering. After spending five years with Bethlehem Steel Co., he joined Haynes Stellite Co. as a sales engineer in 1922, becoming chief engineer three years later. In 1927 he entered the sales department, and in 1929 became general sales manager. He was elected vice president in 1939, and in May, 1944, was made vice-president and general manager, and a director of Haynes Stellite Co. LeVan will continue to make his headquarters at Kokomo, Ind., where the general offices and plant of Haynes Stellite are located.

• **Leslie Cooke,** a former employee of Community Public Service Co., Ft. Worth, Tex., was recently appointed assistant treasurer and office manager of the company upon his honorable discharge from the Army. He succeeds **John P. Shell,** who was commissioned an ensign in the U. S. Navy.

Mr. Cooke started his business career with the old Texas-Louisiana Power Co. as office boy and stockroom clerk, and was subsequently promoted to various important positions until he enlisted in the Army Enlisted Reserve Corps in 1942.

• **George W. Cupit, Jr.,** has been appointed chief chemist of the motor fuel division of the Oklahoma Corporation Commission, in charge of the Commission's laboratory at the state capitol and the mobile laboratory for testing oil and gas pressures in the field.

Before appointment, he had been employed as chemist at the duPont powder plant in northeastern Oklahoma.

• **Earl J. Newlin** is the new secretary and treasurer of State Fuel Supply Co., Oklahoma City, Okla., it is announced by **M. T. Drisko,** vice president. He succeeds **Ray K. Osborn.** Previously connected with the company, Newlin returns after an absence of several years during which he was employed in the general offices of Consolidated Gas Utilities Corp., Oklahoma City.

• **Mrs. Alta Ewalt Evans,** editor of Southern Union Gas News, company magazine of Southern Union Gas Co., Dallas, Tex., has been elected president of the National Council of Industrial Editors. Among five vice presidents mentioned was **Charles J. Morse.** The Peoples Gas Light & Coke Co., Chicago.

• **William H. Tipton,** advertising manager for Houston Natural Gas Corp. from 1936 to 1939, was recently made a junior member of Franke-Wilkinson-Schiwetz, advertising agency of Houston, Tex. Until the outbreak of the present war, Mr. Tipton had been active in the company's planning and promotion of dealer-cooperation sales campaigns.

• **Harry K. Wrench,** president and general manager of the Minneapolis Gas Light Co., has announced the appointment of **Lester J. Eck** as assistant general manager of the company. Eck is also a vice president and has been in charge of operations, which function he will continue to supervise.

Manufacturers

•At a director's meeting held August 25, 1944, **Alden P. Chester** was elected president of the Globe American Corp., and **A. G. Sherman** was elected vice president.

Chester has been actively associated with the stove industry since 1925, when he became sales representative for Chambers ranges, and later general sales manager. In 1930 he was made vice president of Globe American, and was appointed general manager of the Kokomo division in 1935.

He had also served as president of the Institute of Cooking and Heating Appliance Manufacturers from 1938 to 1940, and is now chairman of the gas range manufacturers' division of the institute.

A. G. Sherman has been with Globe American since 1940 as plant manager at Kokomo, and has served as president of the Detroit Vapor Stove Co., acquired by the Norge Division of Borg Warner.

W. D. Harvey, manager of the Macomb plant of the company, was elected chairman of the Board.

At the same meeting, the Board of Directors approved the general plan for postwar production of Dutch Oven Ranges at the Kokomo Plant of the company when war production contracts are completed. This plant is now turning out all-steel life boats and life rafts, and has produced better than 50% of those used on Liberty and Victory ships.

• **Edward R. Martin** has been named chief marketing statistician for Servel, Inc.,Evansville,Ind., it was announced recently by **Lyman Hill,** sales research director. Before coming to Servel, Mr. Martin was associated with the American Gas Association in New York for nine years as superintendent of statistical activities. He is a graduate of Pace Institute, N. Y.

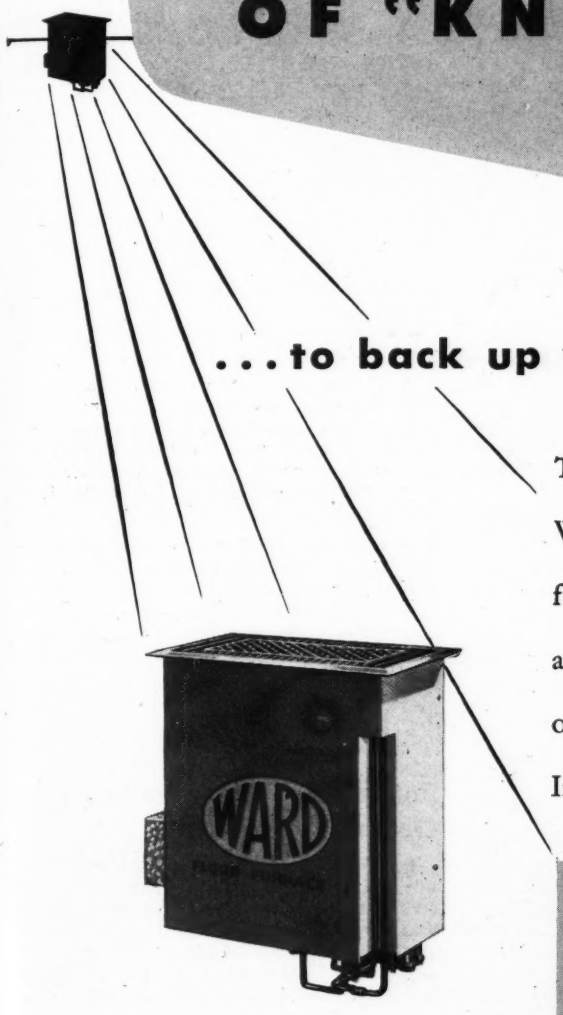
Edw. R. Martin

• The Foxboro Co., makers of industrial instruments for measurement and control, announces that **Walter H. Ridley** has joined the sales promotion department, at the head office, Foxboro, Mass. Since graduating from M.I.T. in 1928, Ridley has been engaged as designer and sales engineer for two well-known firms manufacturing textile mill machinery. For the past two years he has been in the Boston office of WPB, where much of his work concerned the problems of the textile industry.

• **Earl McGee** is new works manager of Renown Stove Co., Owosso, Mich., according to a report by **B. A. Nagelvoort,** president. Before becoming affiliated with Renown, McGee had been employed by Standard Gas Equipment Co. for the past 30 years.

35 years

OF "KNOW-HOW"



. . . to back up your postwar selling plans

There is no substitute for experience. Since 1909 WARD Heater Company has been making floor furnaces. When you sell WARD you are selling a line that is soundly designed from the standpoint of quality, service, efficiency and sales-appeal. In making your postwar plans consider WARD.

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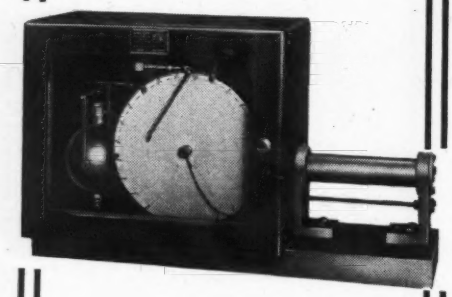
Major Company Engineers Select



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For Determining SPECIFIC GRAVITY OF HIGHLY VOLATILE LIQUIDS

1—OPERATES UNDER ACTUAL LINE PRESSURE. High working pressure prevents release of gas—an extremely important feature in measuring specific gravity of highly volatile liquids.

2—AUTOMATIC TEMPERATURE COMPENSATION. Produces highly accurate and fully corrected record of specific gravity of liquid under any designated standard temperature conditions.

3—CONTINUOUSLY FLOWING SAMPLE. Changes in specific gravity shown with minimum time lag. Pressure necessary to produce required flow is only a few pounds per square inch, except for very viscous liquids.

4—NO MOVING JOINTS OR STUFFING BOXES. Friction and leakage eliminated. Instrument is delicately responsive to minute changes in specific gravity.

5—INDICATING AND RECORDING TYPES. Either type available with automatic temperature compensation. Can also be made of non-corrosive materials.

SEND FOR BULLETIN NO. 111-A

American
RECORDING CHART CO.
3113 E. 11th St.,
Los Angeles 23, California

• **A. B. Banowsky,** for 13 years associated with the United Gas System, on Sept. 1 was appointed manager, Retail Division, Payne Furnace & Supply Co., Inc., with headquarters at "Payneheat's" general offices in Beverly Hills, Calif., according to an announcement by **E. L. Payne,** president.

A. B. Banowsky

Upon entering the "United Gas" organization, he specialized in sales and installation of gas heating and air-conditioning, and for six years prior to joining "Payneheat," was commercial and industrial sales manager for United.

Mr. Banowsky, for the past 18 months has been acting chairman of the AGA sub-committee on Approval Requirements for Central Heating Appliances, of which he has been a member for five years; and for the past three years has been chairman of the Duct Furnace Sub-committee.

• **R. L. Fowler,** president, Florence Stove Co., Gardner, Mass., has announced the retention of **Ralph E. Kruck,** industrial designer of Springfield, as new product designer of the company. Mr. Kruck had resigned from Westinghouse, where he managed the product design department at Mansfield, Ohio, to organize his own firm before joining Florence Stove. In referring to the announcement, Mr. Fowler said, "Mr. Kruck's appointment is one step in our extensive plans for postwar expansion. **Frank H. Schneider** is in charge of a large, modern merchandise development department, and Mr. Kruck is working closely with him in designing all types of Florence ranges and heaters."

• **Edward Falck,** director of the Office of War Utilities of WPB, announces as of Aug. 12, 1944, that **Frederick B. Tracy,** formerly deputy chief of the Gas Materials Distribution Section, has been appointed chief of the same section to fill the vacancy created by the resignation of **George H. Smith.**

Since July, 1942, Tracy has been associated with the Materials Section of the office of War Utilities.

Prior to his Washington connection, he was associated with Dawes Brothers of Chicago, until 1929. Since that time, Tracy has been associated with North American Co. properties in Nebraska and Illinois, coming to Washington from the Illinois Power Co. Division office at Galesburg, Ill.

• **James M. Brodbeck,** district manager, Welsbach Street Lighting Co., New York, has been appointed division manager, Chicago, according to an announcement by **Morse DellPlain,** president. In his new capacity, Brodbeck will supervise in Chicago, St. Louis and Kansas City the operations of the Welsbach Street Lighting Co., a subsidiary of the Welsbach Engineering and Management Corp.

Formerly manager of industrial relations, Northern Indiana Public Service Co., Hammond, Ind., Brodbeck joined the Welsbach organization in 1938.

James R. Campbell, assistant manager, New York, has been appointed district manager to replace Brodbeck.

Obituaries

• **Earl R. Ernsberger,** 67, former natural gas and electric utility executive, died Sept. 9 at his home in McAllen, Texas.

During the early 20's he organized the Southwestern Light and Power Co. of Lawton, Okla., which, under his management, grew into a gas and electric utility serving about 120 cities and towns in Southwestern Oklahoma.

After selling these properties to the Public Service Co. of Oklahoma, he organized the Western Service Co., Oklahoma City, which obtained gas franchises at Guthrie, Shawnee, and other towns.

• **Charles Cornwall Reed,** 59, general superintendent of the Hope Natural Gas Co., Clarksburg, W. Va., died recently following a heart attack. Mr. Reed joined Hope in 1910 as assistant superintendent of the meter and gasoline department and in 1920 was made superintendent of the Hope Construction and Refining Co., serving in that position until he was made assistant general superintendent of the entire Hope organization. He was responsible for much of the pioneer work in the ment and perfection of the absorption method of gasoline extraction from natural gas.

• **George Barker,** 68, vice president in charge of real estate and purchases and a director of the Public Service Corp. of N. J., died Aug. 23. Mr. Barker was first employed by the Prudential Insurance Co., and later by Fidelity Union Trust Co. In 1903, when the Newark Consolidated Gas Co. was amalgamated with the Public Service Corp., he was secretary-treasurer, in 1905 became real estate agent for the Public Service Corp., and in 1925 was made a vice president.

• **A. C. Harper,** chief inspector for Lone Star Gas Co., Dallas, Tex., died recently from injuries sustained in an accident which occurred near Athens. Mr. Harper had worked under direction of **J. A. Martin,** supervisor of inspection and structure maintenance.

• **Samuel W. Davison,** 51, superintendent of the Milwaukee Gas Light Co.'s third ward properties, died recently. He had just completed two years as chairman of the committee on gas manufacture of the Wisconsin Utilities Association.

▼

Petroleum Conservation Orders Revoked

Because they have been entirely supplanted by Petroleum Administrative Order 11 and its supplementary orders, and by Petroleum Administrative Order 12, Conservation Orders M-68 and M-68-c were revoked Aug. 26 by WPB upon the recommendation of PAW.

The action merely eliminates "from the books" two orders that have been incorporated, since their issuance, in the two more-inclusive Petroleum Administrative Orders, which remain in effect.

meters and regulators

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THE NEW SPRAGUE SHOP MANUAL NO. 17

Not a ... war dream but an actuality

THE SPRAGUE METER COMPANY
BRIDGEPORT • CONNECTICUT

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HOUSTON, TEXAS
SAN FRANCISCO, CAL.

TRENDS and COMMENT

By ARTHUR ROHMAN

Pipeline Completed

This month natural gas from the Corpus Christi area in Texas will begin to flow through the Tennessee Gas and Transmission Co.'s 24-in. line to West Virginia, feeding 287,000,000 cu. ft. daily to the Appalachian area, last winter sorely pressed. Undertaken as a war necessity, the natural gas "Big Inch" will be completed on schedule, according to Tennessee's President, Gardiner Symonds.

Pipelines Contemplated

Natural gas is bound to get to California by one route or another. Latest word is that Metropolitan Natural Gas Co., El Paso, Texas has applied to the War Production Board for permission to construct a ine to the West Coast. No details are yet available.

Out west, executives pondered the building of the first long distance pipeline into California. It is expected that an application will be filed shortly with FPC. To be constructed of 28-in. or even 30-in. thinwalled pipe, the $60,000,000 plus project will tap the Hugoton field in Kansas, Oklahoma and Texas.

Natural Gas for Nashville

Natural gas will supplant or supplement manufactured gas service in a triangular section of Tennessee, bounded by the cities of Chattanooga, Knoxville and Nashville, if the Federal Power Commission approves the application filed by Tennessee Natural Gas Lines, Inc., Sept. 5 for permission to construct and operate facilities to make the gas available to Nashville. Total combined population of the three cities is over 420,000, and approximately 28,000 meters would be affected should the changeover materialize.

Tennessee Natural Gas Lines, which was organized for the purpose of constructing and operating the facilities covered by the applicaiton, first proposes a 10¾-in. 17-mile line between the Tennessee Gas and Transmission Co. line near Ashland City, Tenn. and Nashville. Cost of the project would be $385,977 to be financed through issuance and sale of securities.

Construction of the facilities proposed would fulfill in part the original plan of Tennessee Gas and Transmission to make natural gas available to unserved areas in central and eastern Tennessee. It is proposed to deliver an average of 3 million cu. ft. per day at the city gate of Nashville to the Nashville Gas and Heating Co., which now distributes manufactured gas in the city and environs, and additional sales to industries contiguous to the pipeline system are expected to aggregate at least 4 million cu. ft. per day.

It is the plan of applicant, as soon as materials become available for the purpose, to construct facilities to make natural gas available to other unserved areas in the State of Tennessee, including the cities of Chattanooga and Knoxville.

Greatly expanded facilities for war production will make it possible for Utility to produce more and better gas-fired heating equipment when victory comes.

Peace-time Manufacturer of the Famous Utility Air Koolers, Blowers, Fans, Floor Furnaces, Circulating Heaters, Unit Heaters, and Force Air Furnaces.

UTILITY FAN CORPORATION

4851 South Alameda, Los Angeles 11, California

Rockwell's Plan

Most everybody in the gas industry must by now be somewhat familiar with Col. W. F. Rockwell's proposed plan for postwar unemployment compensation. The plan, we understand, is before Congress, which has gone home to get itself re-elected.

Briefly the plan, as stated by Col. Rockwell, is:

> ". . . that war contractors be allowed to retain a percentage of their war production profits, after normal but before excess taxes and renegotiation, for the purpose of setting up unemployment compensation for their own individual workers. Under this plan the contractors would assume the responsibility of unemployment compensation payments upon the same basis as the state in which they were located. As an incentive to fast reconversion, these war contractors would be permitted to utilize any funds unexpended for unemployment compensation to aid them in getting back into peacetime production. Within two years after final settlement of war contracts, however, all war contractors using any portion of such reserves would have to return these balances to the U. S. Treasury. Thus there would be no permanent benefit for the war contractor under this plan."

As we understand it, this fund would provide money *immediately* for war workers thrown out of employment through contract cancellations. In addition, it would provide funds *immediately* from which the manufacturer could borrow during the period of reconversion. Sounds like a workable plan, one that would place upon the employer the responsibility of taking care of his workers; one that would circumvent the interminable processes of government; one that would most quickly start the wheels of peacetime industry.

Wonder Kitchen

For *Time* readers who have already contributed the Aug. 28th issue to the paper drive, we recall the article, "Kitchen Front" published under "Science," p. 84. This item we read carefully twice and now swear that there was never once, among all the electrical wonders promised for the future, one mention of the word, "gas."

Elizabeth Sweeney of *McCall's Magazine*, also has a few things to say about what 53,000 women think of their kitchens, present and future. Complaints: (1) 30% of the women questioned found their kitchens too small; (2) 41%, inconvenient to work in; (3) 30%, inadequate sinks (This complaint strikes our heart; the next time we build a house in a hurry just before a war, we are going to make certain of one thing, that the water which inevitably collects on the drainboard flows serenely into

STANDING GUARD FOR SAFETY

H-M LOW PRESSURE REGULATORS give dependable, long-life service, economically and with a minimum of attention. Precision engineered, these regulators control the gas flow...regardless of main-line pressure.

Although our plant is now working at capacity on vital war equipment, a limited supply of regulators is still available.

Send for complete details regarding available sizes and specifications.

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A Regulator for Every Purpose

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Is hidden corrosion cutting the life of your gas holders in half? This 16-page bulletin gives many helpful facts and detailed information on the development of corrosion—and how to combat it—in gas holders. Send for your copy today.

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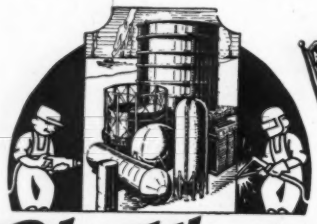

Stacey Brothers
GAS HOLDER
Inspection Service
HIDDEN CORROSION
MEANS DANGER and EXPENSE
Stacey Brothers Gas Holder Inspection Service brings it to light, and presents tried and proved means of arresting corrosion and restoring any damage already suffered
THE STACEY BROS. GAS CONSTRUCTION CO.

Stacey Brothers
GAS HOLDER INSPECTION SERVICE
ENGINEERS • FABRICATORS • RECOGNIZED EXPERIENCE & FACILITIES

GAS METER INDEXES AND FITTINGS

Many Standard Meter Parts Carried in Stock

We will be pleased to submit quotations to your specifications and blueprints.

THE E. F. GRIFFITHS CO.

346 E. Walnut Lane **Philadelphia 44, Penna.**

IT'S LIKE *writing* A LETTER HOME

These ads month after month . . . telling you that all of our production is going to war . . . are simply to remind you that the name to remember when you want real snap-acting gas controls after the war is

SPENCER THERMOSTAT CO. KLIXON ATTLEBORO, MASS.

the sink and does not rush like Seabiscuit for the far turn down the board, around the corner and out for the back door); (4) 60% not enough storage space, inadequate counter work space.

What the little woman of tomorrow isn't going to have in her kitchen isn't worth publishing. That kitchen of tomorrow will make Gen. Patton's 2nd Armored division look like George Armstrong Custer chasing the Sioux Indians. Freezing food, killing germs, drying towels, exterminating vermin, washing dishes, mirrors, radios, pots, pans, telephones, desks, books, shelves, blackboards—all in any color you want and covered with glass.

Next we read that the kitchen is a dodo; it's abolished; throw the whole thing out. That the intricate mechanisms which make up the woman's workshop will be disguised and hidden in the living room. A trap door in the middle of the floor for dirty dishes (and some people); a deep freezer behind the volume of E. A. Poe with woodcuts; a sliding panel hides the oven; for a handy banana, a desk drawer.

We guess we are old school. We want a kitchen—an improved kitchen with the drainboard flowing the right way, a good range without burner covers which come off; a quick freezing box with unbreakable ice cube containers which deftly and automatically flip their product into the nearest waiting glass.

But we want a kitchen. It is the only place in the world where three slightly befogged but articulate gentlemen can gather, like Roosevelt, Churchill, and Stalin, and with broad gestures, and sweeping sentences solve the world's politics and social problems.

Electric Hour

The electric companies are again selling their wares to millions of radio listeners each week. Nelson Eddy is the star of their show, "The Electric Hour" (it's a half hour show), which can be heard over the entire CBS network at 10:30 p. m. EWT each Wednesday. The programs originate in Hollywood's Radio City. Eddy will be accompanied by Robert Armbruster and a symphonic-type orchestra.

Informal in character, the half hour will bring to listeners the best in music, whether it be operatic or a romantic ballad of today, a Gilbert and Sullivan "patter" song, or a melody from our Latin American neighbors. Many of the hit songs of Eddy's motion pictures will be heard. Eddy will announce his own numbers and is expected to bring a note of informality to the half hour.

Woman Laboratories Worker Awarded M. A. Degree

The first feminine scientist of the American Gas Association Testing Laboratories staff to receive a degree of Master of Arts is Miss Elizabeth McNutt. She completed required studies during a six weeks' term at George Peabody College at Nashville, Tenn., and was awarded the degree of Master of Arts in Home Economics on August 25.

Miss McNutt has been employed by the Laboratories since September 15, 1943. Prior to that time she had secured credit for all but six weeks' work toward her advanced degree and consequently was granted a leave of absence this summer to complete her studies. At the Laboratories she has been one of the women staff members who have made possible continuation of activities which otherwise would have been most difficult under existing manpower problems. During the past year she participated in domestic gas research studies and helped with the war program. She is now assisting in publication work.

Following graduation from East Texas State College in 1941, Miss McNutt taught vocational home economics at Overton High School, Overton, Texas. Her home is in Tyler, Texas.

New York Utility Moves Headquarters

Executive headquarters of the Niagara Hudson System have been transferred from New York to Syracuse, where the system's main offices had been located since June, 1929. Earle J. Machold, president of Niagara Hudson Power Corp., parent company, stated that because Syracuse is the approximate geographical center of the system's operations, the management believes that these operations can be conducted with greater effectiveness from this city. A statutory and stock transfer office will continue to be maintained in New York City at 15 Broad St.

WFA Cites Servel

Servel, Inc., Evansville, Ind., and gas utility companies the country over were honored recently by the War Food Administration of U. S. Department of Agriculture during Servel's weekly radio show that stars Miss Billie Burke.

At that time, Geo. S. Jones, Jr., Servel's vice president in charge of sales, received for the company a citation from Dr. W. C. Oakie of the War Food Administration.

Over a period of more than a year Servel has spent liberally of its time and money in behalf of a campaign for "Nutrition in Industry." The Billie Burke Saturday morning radio show has only been a part. In addition, through gas utility companies spread throughout the United States, Servel has sponsored a campaign for improved industrial feeding.

Servel will continue Miss Burke's "Fashions in Rations" program for another three months' period.

Servel's Vice President George Jones receives a citation from Dr. W. C. Oakie of WFA.

6,500 MILES OF GAS MAINS

have been treated with CARBOSEAL Anti-leak

Experience on 6,500 miles of gas mains has shown that treatment with Carboseal Anti-Leak is one of the quickest methods of checking gas leakage. This method saves *labor, gas, money* and *materials;* and the job can be done without tearing up streets or shutting off service.

Leakage reduction of 90 to 100 per cent is usual. Actual tests on joints 11 years after treatment with Carboseal Anti-Leak show that the joints remain tight.

A booklet, "Correcting Leakage in Gas Distribution Systems with Carboseal Anti-Leak," tells more about this treatment—how to apply it, how much it costs, what results can be obtained. Write for a copy.

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Unit of Union Carbide and Carbon Corporation

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CARBOSEAL *Anti-leak*

CURRENT READING

New Combustion - Control Methods for All Standard Fuels—R. Reed, "Transactions, A.S.M.E.," July, 1944, pp. 407-412. As a result of extensive study and field experience with combustion problems, the author offers suggestions for increasing the accuracy of combustion control in all types of standard fuels. This is accomplished by overcoming the existing limitations of flue-gas-analyzing methods either by recorded CO_2 concentrations, or by Orsat analysis. Curves are given which provide a simple means for determining "excess air by CO_2" and "excess air by O_2," by the use of which excess-air control can be quickly adjusted for any change in fuel to obtain unimpaired combustion. The importance of determining the presence of aldehydes in flue gases is recognized and a positive method for their indication has been developed in the form of a simple apparatus which is described. This check on combustion may save considerable fuel, and a great deal of mechanical difficulty with furnaces.

National Bureau of Standards Letter Circular LC-757, "Volume Corrections Factors for C_4 Hydrocarbon Mixtures"—compiled by C. S. Cragoe. A sequel to LC 736 (GAS, April, p. 58), and also prepared at the request of the Rubber Reserve Co. in order to: (1) supplement the tables on pure hydrocarbons issued Nov. 23, 1943, as National Bureau of Standards Letter Circular LC-736 "Liquid Densities of Eleven Hydrocarbons Found in Commercial C_4 Mixtures"; (2) supply standard tables especially applicable to C_4 mixtures covering a wide range of composition; (3) facilitate accurate determination of quantities (in gallons at 60° F. or in pounds) bought and sold in commercial transactions; and (4) supersede various tables of volume correction factors which are not sufficiently accurate to permit precise computations of quantities of C_4 mixtures for use in commerce, particularly in the manufacture of aviation gasoline and 1, 3-butadiene.

Gas Turbines and Turbosuperchargers—S. A. Moss. "Transactions, A.S.M.E." July, 1944, pp. 351-371. For some time the author has been associated with many of the developments relating to the gas turbine and particularly to the perfection of the airplane-engine turbosupercharger. It is from this intimate and interested viewpoint that he outlines the history of the gas turbine and its potential use as a prime mover. A comprehensive bibliography of the art of gas-turbine design has been included in the paper to support the author's purpose of outlining the evolution of each component of the modern gas turbine from its earliest inception.

Incompressible vs. Compressible Flow in Pipes—R. C. Binder. "Chem. and Met.," June, 1944, pp. 99, 100. When a compressible fluid flows adiabatically in a pipe the relations are simple and well understood.

The "Traffic Cop" of the Gas Line—L. E. Adler. **"Petroleum Engineer,"** June, 1944, pp. 168, etc. Author describes a graphic pressure chart that keeps dispatchers on their toes. Illustrated.

Method for Calculating Heat Losses Through Refractory Walls—"National Petroleum News," July 5, 1944, pp. R-434, 436, 437. A suggested procedure for calculating losses in heat in its transmission through walls of refractory materials is included in the latest manual of Standards on Refractory Materials of the American Society for Testing Materials. In petroleum refineries such a method would find application in the use of refractory walls for boiler furnaces and furnaces for processing units, also in the more recent use of refractory linings for reactor vessels and large size piping in processes where solid catalysts are used, where the refractory material is applied for abrasion resistance to the catalyst at high operating temperatures.

Catalytic Dehydrogenation of Natural Gas Hydrocarbons—C. H. Riesz, T. L. Pelican and V. I. Komarewsky—"Oil and Gas Journal," July 15, 1944, pp. 67-69, 96. Single-pass dehydrogenation of n-butane, i-butane, propane and ethane has been carried out in the presence of a co-precipitated chromium oxide-alumina catalyst at 450° to 550° C. and atmospheric pressure. At these conditions equilibrium deyhdrogenation concentrations were closely approached. The practicability of the co-precipitated catalyst is discussed.

A Series of Enthalpy-Entropy Charts for Natural Gases—G. G. Brown, "Petroleum Technology," July, 1944, 12 pp. Enthalpy-entropy diagrams are presented for natural gases of 0.6, 0.7, 0.8, 0.9, and 1.0 gravity over the pressure range of 5 to 10,000 lb. per sq. in. and temperature range of 32° to 700° F. The charts indicate directly the work requirement and temperature rise for adiabatic compression or temperature change for free expansion of natural gases.

Flexibility of Underground Gas Storage Demonstrated—W. R. Kubista. "Oil Weekly," July 31, 1944, pp. 22, etc. Usefulness of Osage project has exceeded original expectations of Oklahoma Natural Gas Co., which now plans automatic operation through remote control. Gas is being delivered directly into Tulsa medium-pressure system.

Fletcher Oil Co., Wilmington, Calif., Converts Polymerization Plant to Depropanizer. "Oil and Gas Journal," May 11, 1944, pp. 122, 124. An entire catalytic polymerization plant is converted into a vapor fractionation and depropanization plant at very small cost, as described in this article. Only a few changes were required. Illustrated.

How Different Size Gas Caps and Pressure Maintenance Programs Affect Amount of Recoverable Oil—J. Tarner. "Oil Weekly," June 12, 1944, pp. 32, etc. Calculations show advantages of field unitization especially where gas cap forms appreciable part of total reservoir volume.

Chemicals from Natural Gas and Natural Gasoline—J. H. Kunkel. "Petroleum Engineer," June, 1944, pp. 70, 72, 74. Hydrocarbons contained in these products offer wide field for manufacture of industrial chemicals.

Concepts and Methods of Cathodic Protection—J. M. Pearson. "Petroleum Engineer," May, 1944, pp. 219, etc. Part 3 and last.

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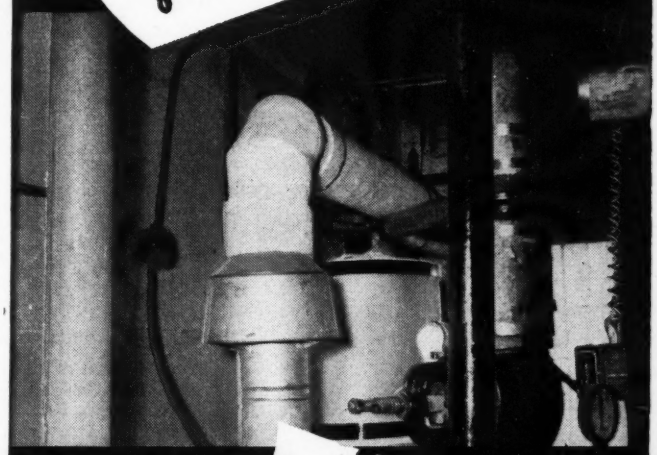

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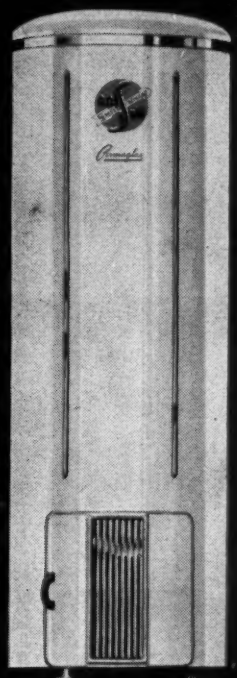

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Manual for Architects Published

THE "Architects Manual of Modern Gas Service" will be available in the near future to all gas companies for distribution to their Architects and Builders.

The work is being carried on by the Sub-Committee on Publicity and Specifications under the auspices of the Committee on Housing. Leon Ourusoff is chairman of the latter committee and the sub-committee is under the chairmanship of H. P. Morehouse.

Purpose of the manual is to inform the architect and builder on quality equipment; to outline recommended practices for the installation of various gas appliances in the home; to supply him with uniform manufacturer's specification sheets for various appliances giving necessary information on roughing-in dimensions. Wherever practical, sample architect specifications for the installation of the various types of appliances are being prepared.

Material is being obtained from such authoritative sources as American Institute of Architects, American Standards Association, American Gas Association, American Society of Heating & Ventilating Engineers, National Board of Fire Underwriters, National Warm Air Heating and Air Conditioning Association, United States Department of Commerce, Federal Housing Administration and a wide sampling of utility company experience.

This effort to bring together under one cover, all of the available yet reliable information on gas services for the use of the architect and builder has moved forward to the point where completed drafts have been prepared for most of the following proposed sections:

I. Foreward
II. Gas Piping
III. Chimneys, Flues and Vents
IV. Gas Cooking
V. Gas Refrigeration
VI. Kitchen Planning
VII. Gas Water Heating
VIII. Gas Heating
  a. Steam Heating
  b. Hot Water Heating
  c. Winter Air Conditioning
  d. Gravity Warm Air Heating
  e. Floor Furnace Heating
  f. Direct Space Heating
IX. All Year Gas Air Conditioning
X. Modern Home Laundry
XI. Basements and Utility Rooms
XII. New Developments and Miscellaneous Helpful Information

The Manual will be prepared in such a way that the emphasis will appear to be on the technical phases rather than the sales side of gas promotion. However, a reasonable amount of space will be devoted to acquainting the architect and builder with the growth of the gas industry in recent years, our research program, our appliance testing program, certified performance program, etc.

It is planned to use a loose-leaf type of binding with a stiff leather finish cover. The loose-leaf feature will allow additions or changes with the minimum of trouble. This gives the gas company an opportunity and a good reason to make frequent callbacks on the Architect and Builder to keep the Manual up-to-date. The value of this opportunity for frequent contact will be obvious.

The sub-committee will distribute the first draft of the material to a wide selection of gas companies so that the committee can have their opinions and guidance. This will be done at an early date. It is planned to have the completed Manual available late this fall.

Excellent Postwar Opening

on Pacific Coast for young man with Sales experience in Gas industry. Knowledge of gas meters and regulators essential; engineering background desirable. Full details first letter necessary to arrange interview. Write Box 375, GAS, 1709 W. 8th St., Los Angeles 14, Calif.

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Development Engineer—Permanent position to man having the following ability: Experience in gas appliance design, familiarity with AGA testing procedures, knowledge of production, operation and development. Give complete details as to personal qualifications, age, experience. Write Box 350 c/o GAS, 1709 W. 8th St., Los Angeles 14, Calif.

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Jas. Graham Mfg. Co., one of the major Pacific Coast gas range manufacturers, desires to obtain for a permanent position, a graduate engineer having the following capabilities:

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- ***Familiarity with AGA testing procedures.**
- ***Knowledge of production operation and development.**

Give complete details as to personal qualifications, age, experience, education, etc.

Apply Personnel Department, Jas. Graham Mfg. Co., Newark, California.

Oklahoma Gas Production

New natural gas areas opened recently in Oklahoma include the Northern Ordnance well southwest of Calvin, Hughes County, showing an estimated 10,000,000 cu. ft. per day at 5289 ft.

Tibbins Oil Co. brought in a well in Creek County, east of Bristow, with an estimated production of 3,000,000 cu. ft. daily, at 2822 feet.